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TECHNICAL TRANSLATION

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NOTICE

The following definitions apply for the transliterated organizational entities included in the text:

chast'	[voinskaya chast'] - Administrative, line, and supply unit (yedinitsa) of the [branches] of troops, which has a number and banner, e.g., a regiment, separate battalion (batal'on, division) and troop organizations equal to them.
ob''yedineniye	[operativnoye ob''yedineniye] - Large-scale unification of various soyedineniye of the branches of troops, which is nonpermanent in composition and is intended to conduct operations in a war.
podrazdeleniye	Troop unit of permanent organization and homogeneous composition in each branch of troops, which unit forms a larger podrazdeleniye or a chast'.
soyedineniye	[soyedineniye voyskovoye] -- Combination (soyedineniye) of several chast' of one or various branches of troops into a permanent organization (division, brigade, or corps), headed by a command and a staff and including chast' and podrazdeleniye of auxiliary troops and services necessary for combat operations.
Source:	Russian-English Dictionary of Operational, Tactical and General Military Terms, 1958

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IMPROVE YOUR METHODOLOGICAL MASTERY

UNSIGNED

The main task of all personnel of our Armed Forces, as formulated for the present training year by the Ministry of Defense USSR, Marshall of the Soviet Union A. A. Grechko, is to assure high combat readiness, the ability to conduct successful combat operations to destroy any agressor in the most difficult situation. In performing this task, the personnel of the Army and Navy have worked fruitfully during the winter training months. The level of technical training of the troops, particularly the young troops, has increased significantly. Great work has been performed on further strengthening of military discipline, moral-political and psychological training of the personnel.

We have now entered the summer training period, which has always been and still is decisive. Its significance is particularly great for the improvement of field, sea and air skills. Therefore, the Minister of Defense of the USSR has indicated the necessity of increasing the requirements for organization and quality of drills conducted, to see that each trip into the field, each cruise and each flight form a definite step in the direction of combat improvement of the personnel.

One decisive factor in increasing the quality of drills, training sessions and exercises is the high level of methodological preparation of leaders, particularly officers. They must not only know their equipment completely, but also must be armed with training skills and must be master teachers.

One important method of improving methodological knowledge consists of the systematic meetings of officers held in the Chast' and Soyedineniye. These assemblies are designed to expand the horizon of drill leaders, equip them with methodological skills, help them to use the best approaches for training and indoctrination, applying everything new set forth by military theory and practice. The continuous participation of Senior officers in the

conduct of drills at these assemblies helps to see that popularization of leading experience is not partial, but continuous and first hand. It is also important that the Senior officers become more familiar with the qualities of each officer, the strong and weak aspects of his methodological training.

The methodological councils and seminars created in many Chast' and educational institutions can make a great contribution to the spread of pedagogic knowledge. Here, experienced specialists teach the officers effective means for solution of specific problems of training and indoctrination. Commanders and instructors methodological drills and continuous checking of the preparation of leaders for their drills help greatly to increase the organizational and methodological level of all drills. Particular attention should be given to such officers as platoon leaders, company, battery, battalion and group Commanders. Their efforts are the primary factor which determines the formation of the basics of combat readiness.

An ordered system of technical training of specialists requires that training be continuous, harmonically combining theoretical training with practical work on the equipment, group drills with individual study, planned and independent study. An experienced methodologist can capably hold the attention of the trainees, using the entire arsenal of pedagogic recommendations, and see that they understand the essence of the problem, that they accumulate the required knowledge and skills.

One subject of concern of an experienced methodologist is the effectiveness of training, which is assured long before the Podrazdeleniye goes out into the field. The results are primarily good organization of service, careful planning of combat training. This planning is based on the well known methodological principle of going from the simple to the complex. Those leaders who use the combat training plan to compose drill schedules to assure continuous and gradual introduction of new training material work properly, in correspondence with the requirements of pedagogic science. They see that todays lesson is the next step to new knowledge, that the theme of hand is of interest to the troops. However, we must note forget that the development of interest in the trainees specialty is not a goal in itself, but rather a means of increasing their activity in training. The most important thing, the reason for the drills, is the accumulation of deep and firm knowledge and skills, necessary for practical activity. We can speak interestingly on the structure of a mechanism, but if the class has no operating model or other equipment to assure clarity, the knowledge of the trainees will not be deep and firm.

The experience of leaders in the socialist competition has clearly shown the importance of good training materials for increasing training quality. The modern training materials base, created and continually improved on a firm scientific basis, has an exceptionally fruitful influence on intensification of the training process. For example, when automatic devices with feedback are introduced, the time required to perform firing drills is cut to one-third. The active training time of a specialist in a tank firing range, for

example, was increased by 50% in the past year. Effective training complexes have been created for training of missile men, aviators and sailors. A full return on the investment in training materials can be expected only when all training devices are well adjusted, maintained in good condition, do not stand idle and, which is most important, when they are methodologically correctly used.

Recently, considerable attention has been given to the demonstration and use of the objective regularities of mastery of the training material, and interest has risen in the theoretical principles of pedagogics and psychology, in the application of mathematical methods to pedagogics. This has allowed us to find the most effective means and methods of training, quantitative measures of efforts expended and results achieved in the training process. However, they are Podrazdeleniye were types of drills and exercises are not always creatively selected, where the training fields and devices are not sufficiently used. We must eliminate these defects.

All officers must see that combat training is a creative affair, and each man who must train and indoctrinate his subordinates must be involved in its development. It is the duty of drill leaders to approach the solution of methodological problems which arise in connection with the composition of the training group, the model of combat equipment being studied, the specific theme and available material, thoughtfully.

In a speech at the Conference of Ideological Workers of the Armed Forces, the Minister of the Defense of the USSR emphasized that all leaders must constantly seek out new aspects in forms and methods of work. It is necessary that Commanders, political organs, staffs, Party organizations continue their decisive struggle for increased effectiveness of utilization of training hours, for intensification of the training process. Reserves for improvement of combat training must be sought out, particularly by increasing the organizational level of combat training. Refusing to postpone or interrupt drills, remaining always concerned for their quality, great reluctance to excuse men from training -- all this must make up the watchword for each Chast', each ship.

Day by day, we come closer to the great holiday marking the 50th Anniversary of the formation of the Soviet Union. Together with all workers, our multinational Armed Forces are actively preparing for this holiday. In honor of the glorious jubilee, Soviet soldiers have taken on high obligations. Commanders, political workers, engineers, Party and Komsomol organizations must concentrate their attention to see that, as they struggle to achieve outstanding indicators in training and service, the organization and methodology of drills and exercises is even more improved, that military teams pull together, that friendship increases and that cooperation between the defenders of the socialist homeland is improved.

FLUORINE DERIVATIVES IN THE NATIONAL ECONOMY

A. Fokin, Corresponding Member of Academy of Sciences pp 2-5

Comprehensive development of fundamental and applied scientific research and rapid introduction of the results of the research to the national econo have been called upon to play a tremendous role in the performance of the gradios tasks of the Ninth Five-Year Plan. Chemistry will make its contribution to the performance of these tasks as well.

There is not a single branch of the national economy which does not use the products of chemistry or its methods. There is also no element in the periodic table which can be considered unnecessary. For example, fluorine, which until recently had no practical value, is now produced in large quantities; its compounds are finding ever newer areas of application and are used in everincreasing quantities. The production of fluorine compounds will continue to develop rapidly, since the production of high-strength, heat-resistant, electrical insulating, corrosion-resistant and other types of materials, as was noted in the directives of the XXIV CPSU Congress, is one task of the chemical industry.

The chemistry and technology of fluorine derivatives is given great attention, since this area of science and production supports the development of new equipment. It is not an exaggeration to say that without the successes achieved in the area of fluorine chemistry, many new trends in technical progress would be impossible or less effective. The creation of organofluorine compounds doubtless must be considered one of the most important achievements of modern chemistry.

One unique feature of fluorine is that no other element is its equal in oxidizing capacity. Its normal electrode potential is 2.65 v, as compared to the potentials of chlorine and oxygen of 1.36 and 1.22 v respectively. Fluorine molecules have extremely low polarizability. This is explained by the stability of its electron shell and the extremely ionization potential of the fluorine atom (400 kcal/g·atom). The high potential and high affinity

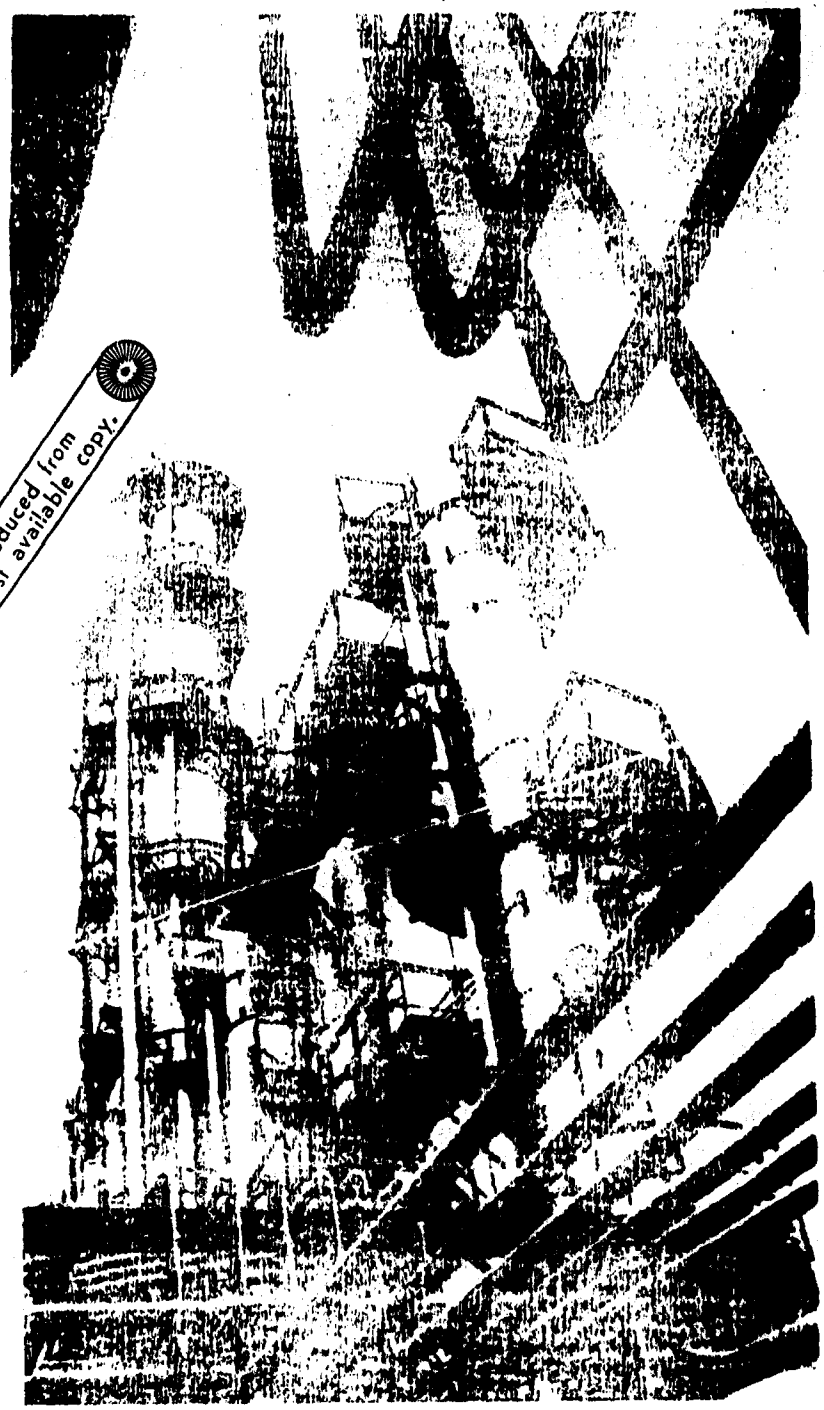
for electrons explains chlorines high electronegativity, higher than any other element. Yet another peculiarity of the fluorine molecule is its low dissociation energy, 37 kcal/mol, as compared to the values for oxygen and chlorine of 118 and 58 kcal/mol respectively. Another unusual property of fluorine is its ability to form extremely strong single bonds with the other elements, with the exception of nitrogen and oxygen. All of this causes fluorine to have exceptionally high reactivity.

The simplest compound of fluorine, and at the same time a key product of the fluorine chemical industry, is hydrogen fluoride. Interacting with metal oxides, it produces metal chlorides needed for technology. It is also the initial product in the production of various fluorine-containing compounds, elementary fluorine in electrolyzers. It is used to extract the atoms of other halogens from a number of organic compounds, replacing them with atoms of [illegible] in processes of electrochemical fluorination.

The production of hydrogen fluoride on the industrial scale was begun in the early 1930's. Previously this acid was comparatively rare and unavailable at the beginning of the century, but has now become a large-scale, extremely important product, particularly in the aluminum industry, with its large scale production of aluminum fluoride and synthetic cryolite. It is consumed in large quantities by the fluorocarbon industry, which has developed many organic fluorides, as well as the petroleum processing industry, where hydrogen fluoride is used as a catalyst for the production of high grade aviation gasoline. The demand for this valuable substance grows continually, and its production will be increased significantly during the Ninth Five-Year Plan.

Fluorocarbon, organic compounds in which hydrogen is replaced with fluorine, are of increasing practical significance. They differ sharply in their properties and reactivity from the corresponding hydrocarbons -- they have higher molecular weight and lower boiling points, chemical inertia and high heat resistance, low surface tension and remarkable dielectric properties. The combination of these properties in some of these substances, which are harmless for man, has resulted in their broad utilization in various areas of modern technology.

New fluorine-containing polymer materials have been created for the nuclear, aviation, chemical and electrical industries, superior in their thermal, electrical and chemical properties to earlier known polymers. They are superior to ordinary carbon chain polymers (polyethylene and polyvinylchlorides) both in their thermal and in their chemical resistance. This, together with other valuable properties, makes them irreplaceable structural materials. For example, polytetrafluoroethylene or fluoroplast-4 (teflon) is more resistant to corrosive media than gold or platinum. It reacts slowly only with elementary fluorine and chlorine trifluoride. It reacts with melted sodium only at temperatures of around 500°C. In many solvents, including chlorinated hydrocarbons, ketones, ethers, alcohols and glycols, teflon not only does not dissolve, but does not even swell. The polymer does not change its properties upon long exposure to boiling, concentrated acids and alkalies or even in aqua regia. Due to these remarkable qualities, teflon is called the organic noble metal.



Part of the [illegible] Chemical Company, Aberdeen, Md., producing the raw material for the production of [illegible]

Together with its phenomenal inertness, teflon has low porosity, excellent electrical and mechanical properties. This mechanical strength is retained at temperatures of from -190 to +250°C. It has low coefficient of friction, almost independent of temperature, and is quite hydrophobic. The dielectric properties do not change at temperatures up to 200°C, the chemical properties -- up to 300°C.

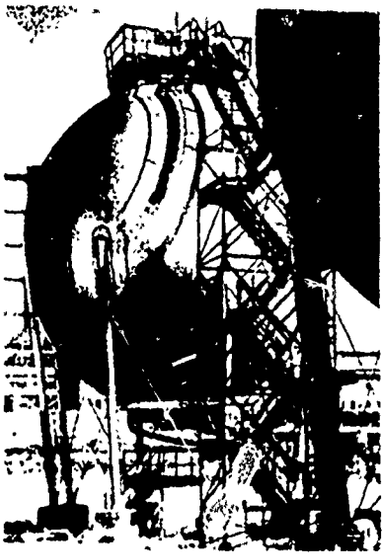
Polyfluoroethylene resins are irreplaceable materials in the electrical and electronic industries. This is understandable, since their electrical properties (specific, volumetric and surface resistance, dielectric losses) are superior to those of other polymers, and meet the rigid requirements placed on materials used in radio relay, television, radar and computer devices, operating at high and superhigh frequencies. It is also important that their characteristics do not change under the influence of pressure, temperature and humidity. The dielectric properties of teflon, for example, are almost independent of current frequency and temperature (between -160 and +280°C).

As an insulating material, teflon is used for the insulation of cables and high voltage lines. If a cable with rubber or polyethylene insulation operates normally at temperatures of up to 85°C, wires covered with teflon can withstand temperatures of 180-190°C. Transformers with teflon insulation can operate at 200°C, allowing the power and efficiency of machines to be increased significantly without increasing their size.

It is interesting that polyfluoroethylene resins are used as lubricating materials. Mechanisms with hydrocarbon lubrication cannot operate at temperatures of -50°C, while mechanisms protected with teflon continue to function at this temperature. Metal covered with a thin layer of teflon will not freeze to the hands, which is very important when mechanisms must be used in the northern latitudes. Teflon is an outstanding means for conserving mechanisms for long term storage.

Copolymerization of unsaturated fluorocarbons has been used to create chemically stable elastic materials, so called fluororubbers. Copolymers of vinylidene fluoride with perfluoropropylene or trifluorochloroethylene (SKF-26 and SKF-32) are exceptionally resistant to the effects of concentrated acids and alkalies. They do not swell in hydrocarbons. Modern nitrosofluororubbers have even better properties.

Fluorocarbon lubricants do not have the shortcomings of lubrication materials and hydraulic fluid based on hydrocarbon compounds. The latter, as experience has shown, breakdown rapidly at high temperatures, are not resistant to oxidation and can burn. Fluorocarbon lubricants are resistant to all types of oxidation and can be used so long in important structures that they are called permanent oils. These oils are produced by fluorination of high-boiling fractions of mineral oil or polymerization of fluoroolefins. Their use not only improves the operation of important machine units, but also makes possible the creation of motors and devices of a new type -- operating at higher temperatures and under more severe conditions than contemporary machines.



Finished product storage tank for shops producing raw materials for synthetic rubber at Nizhnekamskiy Chemical Combine, Tatar ASSR.

Analysis of caprolactam at central laboratory of Grodnenskiy Nitrogen Fertilizer Plant, Belorussion SSR.

Methods have been developed in the USSR for the production of various oils, greases and separating fluids using fluorocarbons, in particular trifluorochloroethylene, polytrifluorochloroethylene, fluoroparaffins and fluorinated petroleum oils. Lubricants 3-F, 4-F, 3-OK, No 5 aviation lubricant and No 8 winter lubricant are used for threaded joints, cranes and fans in contact with acids and strong oxidizers. No 10-OK lubricant is used to soak packing glands in pumps which transfer nitric, sulfuric and chlorosulfonic acids. Fluorocarbon separating fluids are used in manometers, level meters and other devices operating in contact with chlorine, fluorine, fluorohalides, nitrogen tetroxide and other oxidizers.

New lubricating materials based on fluorocarbons are already being used in electric motors, generators and engines operated at high temperatures.

Freons, the simplest fluorocarbons, containing other halogens and hydrogen, are very important in the chemistry of organic fluron compounds. They are widely used as refrigerants in modern domestic and commercial refrigerators, are the basic components for the manufacture of aerosol packages and are beginning to be widely used as working fluids in various power plants. Most of these compounds are also initial raw materials for the production of the primary fluorine and fluorine-chlorine organic products: for example, freon-22 ($CHClF_2$) is used for the manufacture of tetrafluoroethylene, freon-113 ($C_2Cl_3F_3$) -- for trifluorochloroethylene and other fluorocarbons.

The fluorocarbons are the best heat transfer media, and also cooling fluids, for transformers high power radar tubes and various electronic devices. The heat capacities of liquid and saturated vapor fluorocarbons are almost equal, allowing them to be used as gas dielectrics. Also, certain altered fluorocarbons including atoms of other halogens are used as flame-damping fluids. The best of these are dibromodifluoromethane, bromotrifluoromethane and 1,2-dibromotetrafluoromethane. These compounds are significantly more effective and much less toxic than the old flame-damping compounds -- carbontetrachloride and bromochloroethane. We must note that the creation of air conditioning units became possible only after the invention of freons.

Fluoron-containg hydrocarbons are colorless, low-boiling substances with no order. They are harmless, nonflammable and noncorrosive, chemically inert and have high heat resistance. The thermodynamic and physical properties of fluorocarbons are such that they are used as effective heat transfer media. Fluorocarbons and chlorides, with boiling points between 100 and 180°C are used as transformer fluids. Cooling is achieved by boiling without forced mixing. Thanks to fluorocarbons, apparatus can be produced one-fourth the size, one-half the weight, but with the same power capacity.

Until recently, the chemistry of aliphatic fluorocarbons developed more rapidly than the chemistry of aromatic fluorocarbons. This is explained primarily by the fact that it is rather easy to produce saturated fatty series fluorocarbons and that they have practical applications. When the problem of introduction of fluorine to the benzene ring was solved, aromatic fluoro-

carbons began to be significant for industry. The synthesis of perfluorobenzene from hexachlorobenzene treated with potassium fluorides, a readily available raw material, must be considered a significant achievement. Reaction of a basic substance with hexfluorobenzene forms an equally interesting compound -- pentafluorobenzene, which is quite useful for the synthesis of aromatic fluorine derivatives.

Conditions were recently found under which the fluorination of benzene and its chlorine derivatives and subsequent processing produce perfluoroaromatic compounds. Methods have been developed for the production of perfluorobenzene and perfluorinated toluene, piperidene and naphthaline. The appearance of these compounds marked the beginning of rapid development of the chemistry of aromatic fluorocarbons, which have good stability, excellent dielectric properties and low surface activity. Due to their thermodynamic properties, they are used in power plants as heat transfer media or working fluids. Perfluorobenzene is particularly promising in this respect. Some aromatic fluorine compounds, particularly anthraquinone derivatives can act as intermediate products in the synthesis of dyes which are extremely resistant to light and washing.

By making certain changes in the structure of the fluorocarbon molecule, for example by replacing the fluorine atom by an oxygen atom or sulfogroup, organic fluorine surfactants are produced. Like ordinary surfactants, the decrease interphase tension, but still retain their properties in acid media and at high temperatures. So-called chromine, for example, is resistant to concentrated chromic acid under conditions of strong anodic oxidation. The use of this substance in chromination allows a savings of up to 20% chromium. Organic fluorine surfactants are used as additives to plastics to decrease the migration of plasticizers. These substances are used to treat fabrics, leather and paper to make them repel water and oil and increase their strength. Leather products treated with organic fluorine surfactants are not subject to rot, retain their shape well and are more durable. Organic fluorine surfactants can be sorbed onto metals and protect them from corrosion.

The chemistry of fluorine-containing medicines is doubtless quite promising. Whereas the complete or almost complete replacement of hydrogen by fluorine in many organic compounds results in the formation of chemically inert substances, the introduction of one or a few fluorine atoms makes these substances highly reactive, with specific physiological activity. This principle has already resulted in the production of substances for the treatment of the thyroid gland, bronchial diseases, glaucoma, as well as antimalarial preparates and anesthetics. The possibility is being studied of using a number of organic fluorine compounds for the treatment of cancer.

The potential of fluorine-containing medicines can be clearly illustrated by the results of experiments performed with fluorosteroids. It has been found that the introduction of fluorine atoms to steroid compounds, particularly corticosterones, result in deep, comprehensive changes in their physiological activity. The discovery of antiarthyrtic, antiallergenic and anti-inflammatory properties in fluorosteroids has sharply increased the significance of these compounds and allowed their clinical use to be expanded. Fluoro-

steroids are presently used for the treatment of many diseases, including various types of arthritis, Addison's disease, dermatosis and certain types of allergies.

Not only the physiologically active compounds of fluorine, with certain fluorocarbons and freons may be useful for medicine as active blood substitutes. Up to the present time, medicine has used blood plasma substitutes, compensating only for the loss in blood pressure, but not acting as oxygen transfer media. Scientists are now studying the possibility of using new emulsions of fluorocarbons, capable of dissolving significant quantities of oxygen, and see in these emulsions future active blood substitutes, capable of transferring oxygen from the organs of respiration to all other organs. Work on synthetic fluorine blood substitutes is quite promising and will doubtless be developed, together with work on the creation of models of hemoglobin and erythrocytes.

The chemistry of fluorine continues to be a source of unique and frequently unprecedented surprises. Some of these have not yet been explained, while others, in contrast, have helped to explain some of the chemical riddles of the past.

During the Ninth Five-Year Plan, the efforts of chemists and of the chemical industry will be directed toward the creation and production of new fluorine-containing substances, which will supplement the arsenal and polymer and other materials necessary for further development of modern technology.

IN THE RED-BANNER BALTIC

Rear Admiral, Engineer B. Tkachenko (Retired) p 5

Three decades ago, Soviet scientists, designers and fleet officers successfully solved a problem of great importance. They created and installed special devices, protecting warships from enemy magnetic mines. This assured active and successful combat operations of the ships of all types of classes, right up to the victorious conclusion of the Great Patriotic War.

The scientists of Leningrad and officers of the Red Banner Baltic Fleet made a great contribution to the victory over the magnetic mines of the enemy.

The mine situation in the Baltic at the beginning of War was quite serious. On the night of 18 June, 1941, German ships based at Pillau, began to set out mine barriers in the region of Esel and Dago Islands, then the zone of mine placements was expanded to the Bay of Finland. During the first days of combat operations, several of our ships were damaged by these mines. The mines used were magnetic, the characterisitcs were not known to us.

At the beginning of the War, only the battleship Marat was equipped with an antimine protective device. Therefore, the Commanders and specialists of the fleet took a number of emergency steps. On the morning of 22 June, a group of fleet officers and associates of the Leningrad Institute of Physics and Technology (LFTI) met under the leadership of Professor A. P. Aleksandrov to develop a temporary set of instructions for the use of the demagnetizing device on the Marat. The trollers T-202 and T-215 were immediately outfitted with antimine protective windings, and were sent out to combat by that evening. By June 25th, the LFTI-designed devices were installed on two more trollers. Demagnetizing devices following the same standard plan were installed on the destroyer Grozyashchiy and troller Rym.

By the end of June, a special group was created for demagnetizing of ships of the Baltic Fleet. This group was headed by Engineer Subcommander M. V. Shadeyev, its scientific leader was Professor A. P. Aleksandrov. A. P. Aleksandrov went with a group of specialists and installers to Tallin, the main base of the fleet, to organize demagnetization of ships.

Between 26 June and 12 July, 1941, demagnetizing windings were mounted and adjusted on the cruiser Kirov, destroyers Leningrad and Minsk, several Smelyy and Gordyy class destroyers, the Novik pre-revolutionary destroyer, plus a large number of trollers.

The main operations of the Baltic group for demagnetization of ships were developed in Kronshtadt and Leningrad. Between July and October of 1941, demagnetizing devices were installed on the reworked cruiser Maksim Gor'kiy, on the destroyers Storoshevoy, Sil'nyy, Grozyashchiy, Svirepyy, and Storegushchiy, [illegible], minelayer, base trollers and the other ships.

Adjustment of the demagnetizing devices installed according to the standard plans showed that they were not yet perfected: course changes of the magnetic field of the ship were not compensated, the sectioning of the windings did not always correspond to the distribution of the magnetic field of the ship, the cables of the windings were laid outside the hull and were not sufficiently durable.

The specialists worked hard to improve the standard LFTI plans. This work had excellent results: the effectiveness of the demagnetizing devices on surface ships increased significantly. Rules for installation of the windings and their operation were composed and sent out to the fleets.

On the initiative and under the leadership of Engineer Subcommander M. V. Shadeyev, work was actively conducted on demagnetization of submarines as well. On 13 September, 1941, the first coilless demagnetization of a submarine, the Shch-302, was conducted by a method developed by the group of scientiests led by M. V. Shadeyev. In mid-September, instructions were sent out to the fleet for coilless demagnetization of submarines. These instructions were used to demagnetize the submarines Shch-318 and Shch-407 that same month. After the War, M. V. Shadeyev, A. V. Kurlenkov, V. M. Tuchkevich and M. G. Frolov were awarded an Author's Certificate for Invention of the Method of Coilless Demagnetization of Ships, with priority of 15 August, 1941.

The Baltic group of scientists, designers and officers, specialists in demagnetization of ships, working under exceptionally difficult conditions during the blockade of Leningrad, performed the combat assignment to which they were assigned.

SCIENTIFIC ORGANIZATION OF LABOR IN ACTION

Lt. Col. Engineer V. Botin, Lt. Col. Engineer Ye. Golovin,
Special Correspondents p 6

Ten years ago, the workers at the repair enterprise headed by Colonel of Technical Service V. Babich won the honored title of Communist Labor Team. Since that time, this title has been confirmed each year.

Engaged in the socialist competition to meet the 50th Anniversary of the formation of the USSR honorably, the team has taken on the obligation of fulfilling the annual plan early, exceeding the planned indicators as to reduction of cost of production by 2%, increasing the effectiveness of production, savings of material resources. Particular attention has been given to increasing the productivity of labor: by the end of the year, the assignment of the plan for this indicator is to be exceeded by at least 1.2%. The introduction of elements of scientific organization of labor is to be most significant in achieving this result.

The members of the council and the NOT [Scientific Organization of Labor] initiative groups developed recommendations, which served as the basis for rules defining the relationships between Podrazdeleniye and services. As a result, the responsibility of each leader for timely and precise performance of work in the sector assigned to him increased still further, and the control of production was improved.

Based on the recommendations of the NOT Council, the system for supplying the production system with spare parts and expendable materials was improved: most of these materials are supplied to sectors from a central storage area, combined with the main parts supply system. The manufacture of various types of gaskets and seals has been centralized. Transportation within the plant, which now follows a standard route and schedule, is being more effectively used. At one time, the bottleneck was the duplication of technical norms documentation. On the suggestion of the NOT Council, the Commanders assigned a larger room to the copying section. Due to effective placement of copying machines and electrical reproduction equipment, work is now much more convenient. Now one man services several machines simul-

taneously. Together with the Era-M and Vega machines, the shop utilizes equipment manufactured in the shop itself: mortising tables and special cabinets. The illumination at working locations was improved. As a result, the productivity of labor has increased sharply. It has become possible to prepare documents not only for current needs, but considering future needs as well.

The initiative group, headed by Lt. Col. of Technical Service V. Stempnevskiy has adapted the standard technological plan for phosphatizing to the production conditions at the plant. The NOT activists found a solution allowing a smaller quantity of equipment to be used. Washing and degreasing of products was performed in baths on a parallel line. This became possible due to a change in the length of time the water and washing agents were used. On the advice of Lt. Col. of Technical Service V. Drozdov and Major-Engineer V. Konov, the use of technological steam was stopped. The system is now equipped with type A-3130 automatic tube heaters, maintaining the proper temperature with high accuracy. The high temperature drying chamber has been improved, and additional dryers have been installed to improve air quality. Soviet Army employee V. Posokhov made hooks and other devices, allowing parts being treated to be rapidly installed and removed. Transportation of products between operations has been fully mechanized. The position of chemical laboratory technician has been created: all necessary analyses are performed directly in the sector. All of this has allowed a significant increase in the capacity of the line, improving the quality of the parts processed.

Another group under the leadership of Major-Engineer M. Zaremba has redesigned the assembly sector. This group developed and produced universal stands and installations for testing of finished products, has introduced preliminary assembly between operations. Assembly personnel now receive a complete set of everything necessary for their work together with the repaired unit. This has allowed the transition to be made from the individual location to the production line method of repair.

A group led by Captain-Engineer P. Danilov has set up a production line for surface treatment of parts with sandblasting and washing sections. The more effective organization of labor and introduction of progressive technology have increased the usage factor of the equipment in the section.

The overwhelming majority of activists in the movement for scientific organization of labor consists of the rationalizers. Many of these, for example Soviet Army employees L. Altukhov, A. Manukhin, I. Kelin, have made over ten suggestions, the introduction of which has been economically significant. Going forward to meet the 50th Anniversary of the formation of the USSR, the iniators have taken on the obligation of making at least 150 suggestions by the end of the year.

One of the main features of the obligations of each Podrazdeleniye is strict economy. By the end of the year, several tens of thousands of rubles are to be saved by careful consumption of materials and spare parts and by reducing the costs of operations. On the iniative of the Komsomol members, a monthly meeting is held and visits are systematically organized to locate

areas where further savings can be achieved. For example, connection of all compressor installations into a common compressed air system allowed a significant reduction in the expenditure of electric power. The possibility is being investigated of replacing certain expensive materials with less expensive materials. Solvents used for washing parts are now used repeatedly. Special installations were created for this purpose, in which the liquid is decanted and filtered.,

Almost 100% of the personnel have been obligated to confirm or achieve the right to be known as a shock worker of Communist labor. Some 20% of the repair workers are competing for the right to work with their own personal mark. A man with his own personal mark can turn in his work without having it first inspected by the foreman: his coworkers take upon themselves the responsibility for unfailing quality of the work of their Comrade. The workers at the enterprise do not remember a time when this confidence has not been justified.

Many repair workers are competing for the title of best specialist. This title is awarded considering not only the professional qualities, but also the help with which the specialist gives to his Comrades and students. Incidentally, training of specialists from among the young men recently arrived at the enterprise is one of the personal obligations of most experienced masters. We are speaking here both of passing on professional skills, and of indoctrinating the young repair workers with the Communist attitude toward labor and public property.

A commission of representatives of the Podrazdeleniye and services has been set up at the enterprise, and regularly tests the fulfillment of obligations. A scale has been developed for grading the basic indicators, allowing the achievements of various sectors to be compared. Displays have been set up, showing the fulfillment of the obligation of each repair worker. Wall newspapers and radio broadcasts, combat sheets, "flashes," and photographic stories are dedicated to the leading workers. The results are summed up not only for the Podrazdeleniye, but for the enterprise as a whole not each six months as was done before, but every month. This has allowed more timely evaluation of the successes achieved and has revealed the shortcomings indicated in the competition.

Problems of the organization of competition, popularization of leading experience and development of rationalizers work are constantly at the center of attention of the Party, Komsomol and Union organizations. These problems are systematically discussed in the Podrazdeleniye and at general meetings of the enterprise.

The repair workers of this leading enterprise are following the call of the General Secretary of the CC CPSU, L. I. Brezhnev, sounded from the XV Congress of Trade Unions of the USSR, to work better today and tomorrow than yesterday.

THE MINISTRY PRIZE FOR AN OUTSTANDING PODRAZDELENIYE

Major L. Shifrin p 7

For the second time in a row, the traveling prize of the Ministry of the Aviation Industry has been awarded to the Podrazdeleniye headed by Engineer Major V. Borisov. This prize is awarded for outstanding mastery and capable use of the combat equipment. The reason for the great successes achieved by this leading Podrazdeleniye is that the Commander, depending on his Party and Komsomol organizations, capably directs the socialist competition for outstanding servicing and maintenance of the aviation equipment in constant combat readiness, for achievement of rated qualifications, for the title of best specialist. The men always remember that each aviator must be distinguished by faultless behavior, must have model external appearance and must increase his political and cultural level.

The Commander, Party and Komsomol organizations work hard to develop technical creativity among the personnel. And this yields good results. Last year, 34 rationalizers suggestions were turned in in this Podrazdeleniye. Introduction of the best of these, particularly the suggestions of Captain G. Fiskalov, Senior Lieutenant A. Nekrasov, A. Sashenkov, A. Ostskiy, and Senior Sergeant A. Kosmatenko has significantly reduced the times required to make the aviation equipment ready for combat and has increased its operational reliability. Introduction of new technological schedules for post operation testing, performed during the course of adjustment operations, and preparation of the aircraft for flight has allowed complete elimination of omission of any of the operations.

For their successes in combat and political training, model performance of their socialist obligations, the Commander in Chief of the Air Force, Marshal of Aviation P. Kutakhov has personally congratulated the personnel of this Podrazdeleniye. For outstanding observation of the All-Union Slogan of Lenin "We are true to the work of Lenin and the Party," the Komsomol organization has been awarded the honored diploma of the oblast VLKSM Committee.

The personnel of the Podrazdeleniye are now working to meet the national holiday honoring the 50th Anniversary of the formation of the USSR. Before taking on new, increased obligations, the Commander and his political deputies, members of the Party and Komsomol Bureaus, and group chiefs have carefully analyzed the capabilities of the Podrazdeleniye, considered everything positive from the previous experience of organization of socialists competition. Based on the tasks set before the Podrazdeleniye, specific norms were outlined for each group of specialists, for each man.

The Podrazdeleniye strictly observes Lenin's principles of socialist competition: clarity, comparability of results achieved, possibility of repetition of leading experience. When the results are summed up for the month, the Commander informs the personnel of the course of the competition between groups, names the winners, determines the positions they occupy, rewards those who have been outstanding and advises the men to follow the experience of the leaders.

The obligation of active participation in rationalizers work is being fulfilled successfully. Fifteen suggestions have already been submitted, realization of which will be very useful. An example is the installation of a safety diode on a control panel suggested by Senior Lieutenant V. Tenchenko. The reliability of one unit was increased by the suggestion of Senior Lieutenant A. Osetskiy.

As the glorious jubilee date of the 50th Anniversary of formation of the USSR approaches, socialist competition of this leading Podrazdeleniye becomes ever fiercer. This promises that the Podrazdeleniye will not lose its leading position in 1972.

STILL OUTSTANDING IN THE SUMMER TRAINING PERIOD

G. Chagin p 7

Lieutenant Yu. Kabanov, Commander of an outstanding platoon, has shown himself to be a capable methodologist. He conducts each drill with his subordinates in an interesting manner with maximum utilization of training time.

The training process is greatly facilitated by the good equipment which he has made for his radio classroom, in which the troops learn to receive and send the required number of manual morse code groups per minute. The young officer constantly increases his knowledge, and works long and hard on the equipment. In competition among officers in the Podrazdeleniye for the title of best specialist, he won first place. All of this has had a favorable influence on the results of combat training of his subordinates. The communications technicians of the platoon commanded by Lieutenant Yu. Kabanov have achieved great successes in the winter training period and are continuing to rank among the best in the summer training period.

THE CROSS COUNTRY ABILITY OF A MILITARY VEHICLE

Engineer Colonel V. Nikolayev pp 8-9

The tactical and operational mobility of the Armed Forces depends to a great extent on the cross country ability of vehicles. The foreign specialists base this opinion on the significant increase in the number both of transport machines and combat vehicles carrying armament. Therefore, in formulating the tactical and technical requirements for newly developed military vehicles, significant attention is given to their ability to drive not only on roads, but off roads as well.

We know that due to the accumulated kinetic energy, a vehicle can cover more distance over broken terrain the higher its power to weight ratio, the higher the torque of the engine and the higher the other parameters determining its dynamic qualities. Over the past two decades, the specific power of vehicles has doubled, reaching 12-20 hp/t. This has been made possible by the use of more powerful carburetor and diesel internal combustion engines.

Considering that the possibilities for further improvement of these engines have been practically exhausted, the foreign specialists are now looking forward to gas turbine power plants. It is assumed that this type of power plant will have much higher power per unit volume than a carburetor or diesel engine. They are designed for high capacity trucks.

The specific power and trailoring ability are inversely proportional to the total weight of a truck. Considering this, designers use light metals, alloys, plastics, proper selection of strength reserves of parts and units to decrease the weight of vehicles. As a result, the dynamic characteristics are improved and at the same time the specific pressure on the terrain is reduced, helping to increase the cross country ability of vehicles over soft ground.

The ability of a truck to cross open country with trenches, ditches, channels, holes and rocks is determined by the geometric factors of cross country ability, particularly the clearance (Figure 1). In attempting to increase this factor, designers change the arrangement of vehicles and the

design of the running gear. For example, broken axles replace straight axles, and differentials are used, or independent lever-type suspension systems. This allows the clearance to be increased almost to the radius of the wheels.

The cross country ability of a vehicle is also evaluated by such parameters as the radius (both longitudinal and transverse) and angles of the clearance. The longitudinal radius determines the ability of the vehicle to cross a hump, fill or wall without striking the earth with the lowest point of the chassis. Obviously, the lower this radius, the steeper the obstacle which the vehicle can cross. Longitudinal clearance radiuses of not over 2.5-3 m are considered optimal.

As concerns the clearance angles, sometimes called the overhang angle, they determine the ability to cross ditches and vertical walls, and attempts are made to make them as large as possible. The overhand angles of military vehicles with [illegible] cross country quality have already reached 70°.

The behavior of a vehicle over difficult terrain sectors is determined to an equal extent by the quality of the transmission and running gear. It is believed that continuous power transmission, in spite of its low efficiency, has definite advantages over geared transmissions (with gear teeth). By continually adjusting the flow of power, it allows more complete utilization of the power of the engine, improving the dynamic qualities of the vehicle. The transfer number is adjusted smoothly, without jerks, helping to avoid wheel spinning resulting from separation of the surface layer of soil. This property of continuous transmissions particularly helps vehicles to overcome terrain sectors with lose soil cover. This is the reason for the current tendency toward the use of hydraulic and electrical transmissions on military vehicles, which also allow individual drive, so that the power of each driving wheel corresponds to the power which it can actually apply to the ground. We know also that the use of so-called motor-wheels can increase the clearance.

The torque properties of a vehicle, and consequently its cross country ability, can be improved significantly by locking the differentials between wheels and axles. Manual differential locking mechanisms, in spite of their designed simplicity, are being everless frequently used. The problem is that the driver frequently engages these mechanisms only after the machine has become stuck. In this case, even with the differential locked, the vehicle sometimes cannot pull itself out. The preference for self-locking differentials results from the fact that they automatically redistribute torque, depending on the changing conditions of adhesion between wheels and ground. This problem is particularly important in connection with the tendency toward making military vehicles fully driven, with all wheels powered.

The adhesion between wheels and ground depends on the contact area with the supporting road surface, the specific pressure, the type of tread and other design features of the tires.

Ordinary toroid tires (Figure 2) have small contact areas. Although they operate satisfactorily on hard paved roads, they do not assure the required cross country ability on soft soils. This is why military vehicles

are equipped with special tires with adjustable pressure. Their profile is almost twice as wide as that of ordinary tires. If we consider that the initial pressure in this type of tire is only half that in the normal tire, and that as the truck is driven, when necessary, it can be still further reduced, the advantage of tires with adjustable pressure becomes obvious.

The contact area of so-called wide-profile tires is significantly greater. The pressure in these tires can also be changed. Arch tires have extremely low internal pressure and still greater contact area. This gives them high cross country ability.

The shortcomings of both types of tires are their significant rolling resistance and resulting increased loads on the power plant. For this, they are used on military vehicles as a seasonal means of increasing cross country ability.

Machines have been created with special support systems for operation in sandy desert areas and in the far north. These include pneumatic rollers, tubeless barrel-shaped tires (see Figure 2) with low internal air pressure (down to 1.0 kg/cm^2). With high contact area, they significantly reduce the specific pressure of the vehicle on the ground.

In artic and tropical regions, cylinder-screw (snake) supports can be used (Figure 3). Machines with this type of support easily cross swampy areas, since the spiral ridge around the side of the cylinder acts as a screw against the surface of the ground and pushes the vehicle forward.

An amphibian swamp vehicle has been created abroad. Its aluminum body is supported by two pontoons filled with plastic foam and equipped with self-cleaning Archimedes screw projections. The vehicle can travel satisfactorily in swamps and floats. It has been suggested that the installation of retractable wheels can make the device universal, capable of crossing any terrain.

Snow and swamp vehicles with combinations of wheels and tracks, consisting of ordinary pneumatic tires and an endless rubber belt with treads, continue to be tested. Power is transmitted to the belt by the driving wheels due to the friction between the belt and tires. Constant belt tension, regardless of type of soil cross, is provided by a special mechanism. Positive reports have been heard on a special swamp vehicle consisting of two track "belts", the tracks of which are pneumatic rollers.

A wheel-track support system of this type has been suggested for transporters which will use certain parts of existing military vehicles: a six-cylinder, horizontally opposed, air cooled carburetor engine with a standard transmission and differential. To increase the reliability of snow and swamp vehicles, side transmissions have been developed. Using stamped steel, aluminum and glass-reinforced plastic for bodies, attempts are made to decrease the weight of vehicles while at the same time increasing load-carrying capacity and allowing them to fl at.

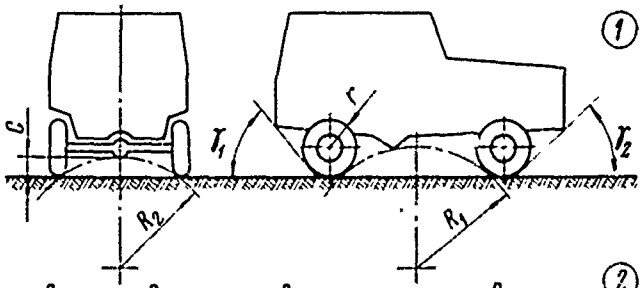


Figure 1. Geometric Factors of Cross Country Ability: C, clearance; R_1, R_2, longitudinal and transverse radii; γ_1, γ_2, forward and rear overhang angles.

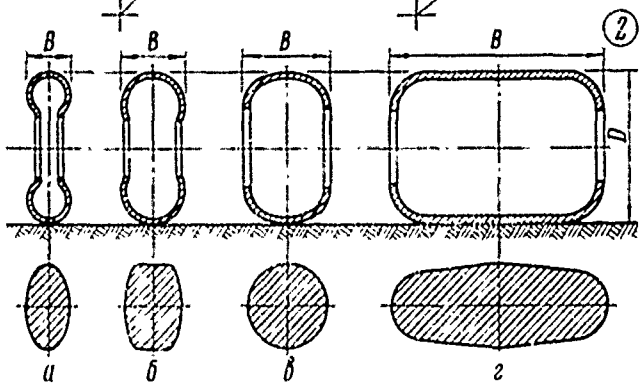


Figure 2. Geometric Parameters of Tires and Comparative Evaluation as to Contact Patch Area: a, toroidal tire; b, wide profile tire; c, arch tire; d, pneumatic roller; D, external diameter; B, tread width.

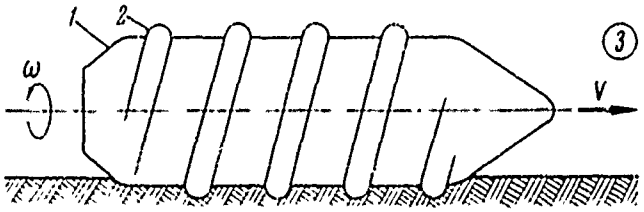


Figure 3. Cylinder-screw (snake) Support: 1, cylinder; 2, spiral ridge; ω, rotation of cylinder; v, forward motion.

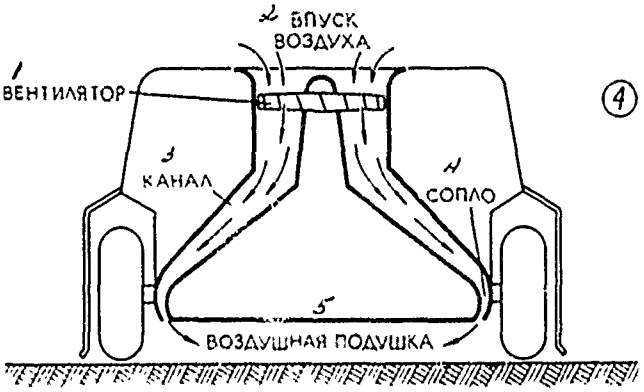


Figure 4. Machine with Partial Unloading of Wheels:
Key: 1, fan; 2, air in; 3, channel; 4, nozzle; 5, air cushion.

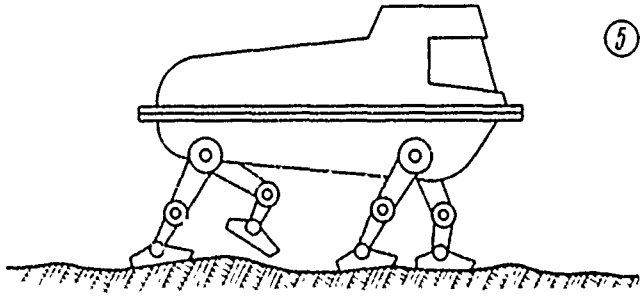


Figure 5. Diagram of Walking Machine.

During the development of military vehicles and special transport equipment with high cross country ability, a trend has been noted toward creation of vehicles consisting of jointed sections. These sections can bend relative to each other in the horizontal and vertical planes and the vehicle retains its stability. With short radii of longitudinal articulation (short distances between neighboring axes), centers of gravity located near the earth and over the center of the wheel base, great overhang angles, articulated vehicles can cross broken terrain sectors quite well. Standard chassises, it is thought, will allow vehicles to be made up of 2 to 5 sections, increasing total load capacity while retaining vehicle weights at between 5 and 8 tons. Several versions of articulated all-terrain vehicles are planned for difficultly passable regions. The most promising include a small transporter with a 12 × 12 wheel plan, having good cross country ability and, which is particularly important, capable of driving at high speeds.

Scientific research and experimental design work on the creation of military transport equipment for arctic regions, the Foreign Press reports, have not yet achieved the desired results, since the basic problem has not yet been solved -- no vehicle has yet been designed with good snow-crossing ability at temperatures below -50°C.

One new trend in motor vehicle design is the development of vehicles which partially relieve the load on the wheels when soft ground is crossed by the air cushion principle (Figure 4). These vehicles are equipped with a rubber skirt around the perimeter of the chassis. Fans pump air into the space beneath the skirt. The vertical reaction which this causes raises the machine, while the wheels provide forward motion. However, foreign specialists assert that the area for use of such vehicles is quite limited.

Yet another type of special vehicle designed for operation under special conditions is the so-called walking machine (Figure 5). Experiments have shown that in driving over the terrain in a walking vehicle, the driver can select individual points for each foot, whereas a wheeled or tracked vehicle requires a continual path to follow. As the wheels or tracks move over soft ground, they continually compact it, and the power plant must expend power to overcome the resulting high rolling resistance.

Quite recently, foreign specialists stated that, using the achievements of science and technology, it would be possible to create an ideal cross country vehicle. However, it was too complex and expensive. Now, planning mass-production motor vehicles for the military, designed to be used under special conditions, the efficiency of using various designs is determined on the basis of the requirements for operational reliability, durability, repairability and economy.

HYDRAULIC BRAKE DRIVE SYSTEMS

N. Vishnyakov, Candidate of Technical Sciences and A. Stepanov, Candidate of Technical Sciences

pp 10-12

The ability to apply the brakes to all wheels of a vehicle simultaneously, distributing the braking effort between the axles and wheels, achieving rapid application and combination with high efficiency, low weight and small size -- these advantages have resulted in wide application of hydraulic brakes on transport and combat vehicles. Their operating principle is based on the property of a fluid of transmitting pressure evenly over the entire closed volume which it occupies.

As an example, let us study the hydraulic brake drive of the GAZ-66 truck (Figure 1). It consists of a master cylinder, connected by brake lines to six wheel cylinders (four for the front brakes and two for the rear brakes), a hydraulic vacuum power brake booster, and a system of arms and levers.

The body of the master cylinder (Figure 2) is divided into two cavities, interconnected by a bypass (large diameter) and compensation apertures. The cover of the body contains another hole, closed by a rubber plug, used to fill the cylinder with brake fluid. The lower portion of the body contains a cylinder with a piston, the base of which contacts a spherical pusher head, connected to the brake pedal. There are six apertures through the head of the piston, covered with a plate valve. A spring pushes a rubber collar against the head. The surface of the rubber collar (contacting the cylinder) has longitudinal channels. At the end of the cylinder is a rubber back valve. A spring is placed between the valve and the collar. The central channel of the back valve is covered with a bypass valve.

The drive operates in the following manner. When the pusher begins to move the piston (when the driver steps on the brake pedal), the collar covers the compensation aperture, isolating the cavity of the cylinder from the reservoir. The fluid is forced out of the cylinder through the bypass valve through the brake lines into the wheel cylinders, driving the brake mechanisms. As the driver releases the pedal, the fluid returns into the main brake cylinder through the back valve. The spring of this valve maintains the required residual pressure in the system.

The sequence of operations is different when the brake pedal is released suddenly. In this case, the spring returns the piston to its initial position so rapidly that the fluid cannot fill the master cylinder and rarefaction arises in this cylinder. This causes the edges of the collar to be pulled inward, and fluid from the reservoir flows into the cavity of the cylinder through the bypass aperture and the holes drilled in the head of the piston, preventing air from entering the cylinder. As the fluid from the lines and wheel cylinders returns to the master cylinder, the excess fluid is forced into the reservoir through the compensation aperture. Due to the arrival of the additional quantity of fluid, it is possible to force more fluid into the wheel cylinders when the brakes are pumped than when the piston is moved just once. This is done by pressing the brakes down rapidly and releasing the pedal rapidly several times. This is necessary if air leaks into the brake lines or if the clearances in the brake mechanisms become too great.

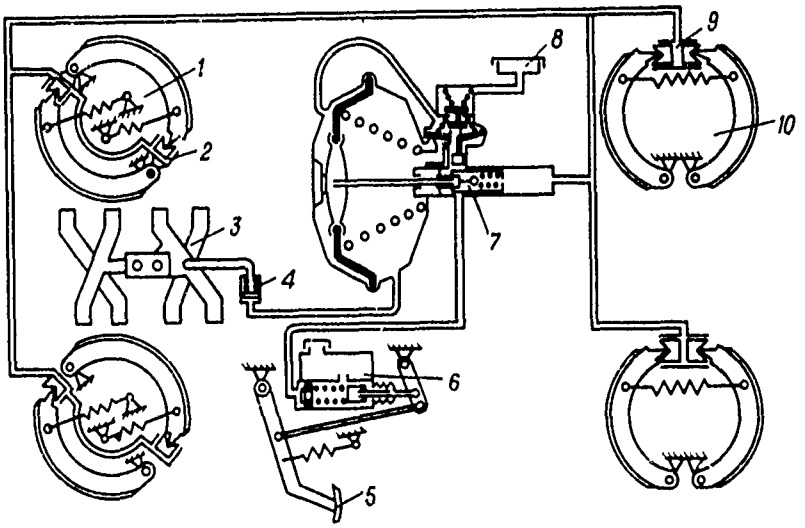


Figure 1. Diagram of Hydraulic Brake System with Power Booster (GAZ-66 Truck):
1 and 10, brakes of front and rear wheels;
2 and 9, wheel cylinders; 3, motor intake manifold; 4, back valve;
5, brake pedal; 6, master cylinder; 7, hydraulic vacuum booster;
8, air filter.

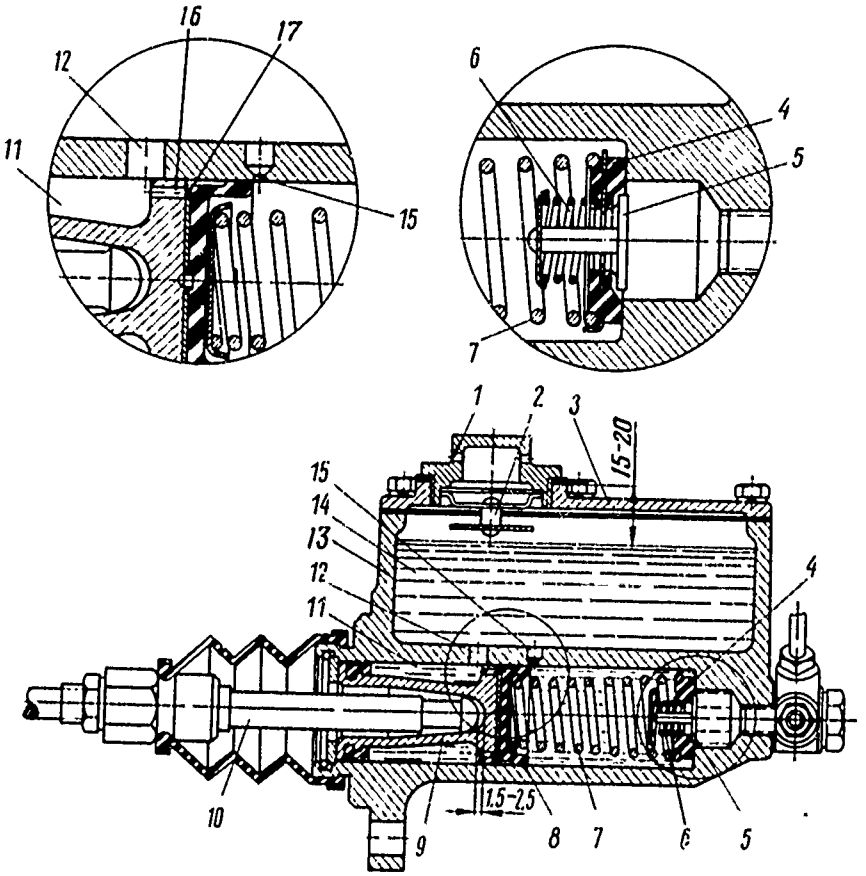


Figure 2. Master Cylinder:

1, plug;
2, reflector;
3, cover;
4 and 5, back and bypass valves;
6, bypass valve spring;
7, piston return spring;
8, piston collar;
9, piston;
10, shaft;
11, cylinder;
12, bypass aperture;
13, body;
14, reservoir;
15, compensation aperture;
16, aperture and piston;
17, plate valve.

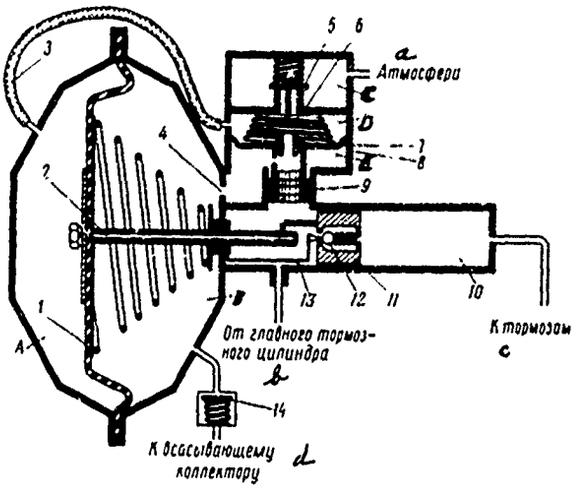


Figure 3. Diagram of Vacuum Booster of GAZ-66 Truck:
1 and 7, diaphragms; 2 and 13, piston and valve pushers; 3, hose; 4, aperture; 5, 6, 12 and 14, valves; 8, body of tracking mechanism; 9, plunger; 10, cylinder; 11, piston.
Key: a, atmosphere; b, from brake master cylinder; c, to brakes; d, to inlet collector.

To release the system completely, the collar of the piston must open the compensation aperture. Therefore, in the initial position of the system, a strictly defined clearance must be maintained between the bottom of the piston and the pusher; this clearance is periodically adjusted.

The presence of the bypass and back valve in the master cylinder assures that there will be a constant volume of fluid in the brake lines and wheel cylinders, regardless of fluid temperature. The excess fluid, when it expands under influence of heat, flows through the back valve and compensation aperture into the reservoir. If the volume of fluid decreases due to cooling or leakage, additional fluid enters through the bypass valve.

One shortcoming of the hydraulic drive is the relatively low transfer number. This is explained by the fact that the force transmitted is limited by the physical capabilities of the driver pressing the brake pedal. This shortcoming has been eliminated using boosters, allowing the brakes to be operated by additional energy received from some secondary source. The source most frequently used is the rarefaction in the intake manifold of the engine (vacuum boosters) or the energy of compressed air (pneumatic boosters).

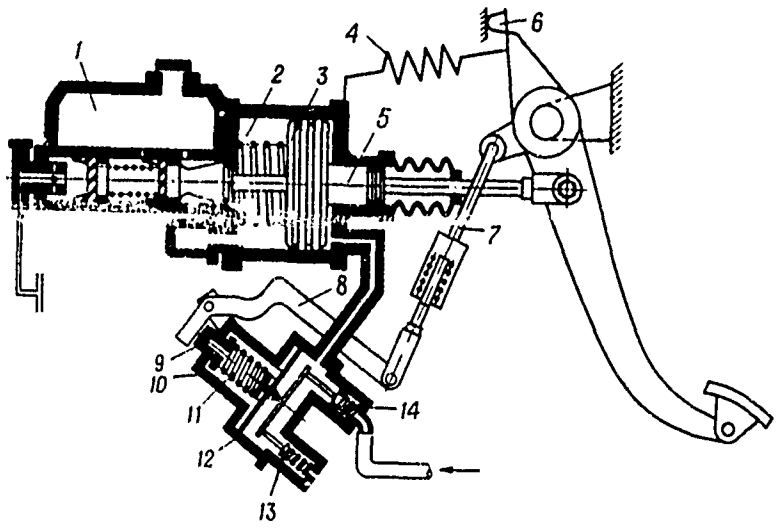


Figure 4. Diagram of BTR-60P Pneumatic Booster: 1, master cylinder; 2, pneumatic cylinder; 3, pneumatic cylinder piston; 4, pedal spring; 5, shaft; 6, pedal stop; 7, arm; 8, valve lever; 9, pusher; 10, brake valve; 11, travel spring; 12, diaphragm; 13 and 14, exhaust and inlet valves.

Vacuum boosters are generally installed on wheeled vehicles with carburetor engines, in which the rarefaction with the engine at the idle reaches 0.5 kg/cm^2 beyond the carburetor valves. In particular, a booster of this type is used on GAZ-66. Its main units (Figure 3) are the vacuum chamber, hydraulic cylinder and tracking mechanism. The body of the chamber is divided by diaphragm 1, the central portion of which is clamped between a washer and a plate resting on a spiral return spring. The plate is rigidly fastened to pusher 2 of the piston. Cavity A of the vacuum chamber is connected by hose 3 to cavity D of the tracking mechanism, while cavity B is connected through back valve 14 and a line to the intake manifold of the engine (see Figure 1).

Piston 11, connected to the pusher so that slight displacement of these parts relative to each other is possible, moves in hydraulic cylinder 10. When the diaphragm is bent to the left under the influence of the return spring, the pusher pulls the piston after it, the movement of which is limited by the pusher of valve 13, mounted in the wall of the body. The contact of the pusher opens ball valve 12, mounted in the piston, compressing its spring.

The lines connect the cavities of the hydraulic cylinder to the master and wheel cylinders of the brakes.

The body of tracking mechanism 8 is installed on a flange in the cylinder, from which it is separated by rubber diaphragm 7, compressed by a spring. The diaphragm carries the seat of a vacuum valve, made as a single piece with plunger 9. The plunger fits a vertical channel in the booster cylinder. The body is divided into three cavities (C, D and E). The apertures connecting them are covered with flat rubber valves -- vacuum valve 6 and atmospheric valve 5, which are interconnected by a rod. Cavity C is connected to the atmosphere through an air filter.

Until the brake pedal is pushed, the fluid in all cylinders and lines of the hydraulic brake system is under a pressure of about 1 kg/cm^2 (determined by the force with which the return spring acts on the back valve). The pusher of the piston and the piston itself of the booster are in the extreme left (initial) positions. The ball valve is open. The diaphragm and plunger of the tracking mechanism are pressed downward, the vacuum valve is open, the atmospheric valve is closed, so that identical rarefaction is created in cavities A and B of the vacuum chamber and cavities D and E of the tracking mechanism. The pressure in the chamber on both sides of the diaphragm is the same.

When fluid begins to flow from the master cylinder into the lines and wheel cylinders, the ball valve at first does not prevent it from moving. However, as soon as the clearances in the brake mechanism are fully used up, the pressure of the fluid in the system increases, causing the plunger and diaphragm of the tracking mechanism to move upward, closing the vacuum valve, and disconnecting cavities D and E. Further movement of the plunger opens the atmospheric valve, and air enters cavity D and cavity A of the booster chamber, which is connected to it. Due to the pressure difference arising in cavities A and B, the diaphragm and the piston connected to it begin moving. The ball valve closes, after which the piston can move only slightly due to elastic deformations of the parts of the brake drive and the brake mechanisms. The lines feeding fluid to the wheel cylinders receive additional pressure transmitted by the shaft from the diaphragm in the vacuum chamber to the piston of the booster hydraulic cylinder. At the same time, since the ball valve is closed, this additional pressure does not act on the piston of the master cylinder or the plunger of the booster.

The diaphragm of the tracking mechanism moves downward until the atmospheric valve is closed. This occurs when the pressure acting downward on the diaphragm, proportional to the force on the brake pedal, equals the air pressure in cavity D of the tracking mechanism. If the force on the brake pedal increases, the pressure of the fluid acting on the plunger is correspondingly increased. The diaphragm moves upward once more, opening the atmosphere valve. The air pressure in cavity A of the chamber increases. The force with which the pusher acts on the piston in the cylinder increases correspondingly.

As soon as the brake pedal is released, fluid pressure is fed under the plunger and the diaphragm of the tracking mechanism bends downward, opening the vacuum valve. The pressure in the chamber on both sides of the diaphragm is equalized, and the diaphragm, together with the pusher and piston, returns to its initial position under the influence of the return spring. The ball valve is opened and the fluid from the wheel cylinders close back into the master cylinder.

Let us note one factor of importance for practice. Obviously, the additional pressure developed by the vacuum booster depends on the rarefaction in the intake manifold of the engine. As we know, maximum rarefaction is created when the engine operates at the idle period. Therfore, braking is most effective when the crankshaft speed is minimal (accelerator pedal released). When the engine stops, back valve 4 (Figure 1) automatically disconnects the vacuum booster and intake manifold. Rarefaction is retained in the booster chamber for sometime, sufficient to allow one or two effective stops. The brake system of the truck also operates when there is no vacuum in the booster chamber, but high pedal pressure is required.

In pneumatic boosters, additional force is applied to the master cylinder piston by the pressure of compressed air from the receiver of the vehicle. A booster of this type, for example, is used on the BTR-60P armored transporter (Figure 4).

The master cylinder is made as a common unit with the pneumatic booster cylinder. The force which the driver applies to the brake pedal is transmitted through a shaft to the piston and at the same time through a lever, elastic link and adjustable fork to the brake valve lever.

The body of this valve contains an elastic metal diaphragm, pusher, spring, inlet and exhaust valves, connected by a bracket; compressed air is fed in through the air line and valve.

The initial position of the brake pedal is determined by the stop. A clearance is maintained between the short arm of the brake valve lever and the pusher. The inlet valve is closed, the exhaust valve is open, the cavity beneath the diaphragm in the brake valve and the booster cylinder are connected to the atmosphere.

When the brake pedal is depressed, at the same time the shaft and piston move, the lever of the brake valve rotates. First, the clearance is used up, then the short arm of the lever depresses the pusher, which acts on the diaphragm through the spring, bending it. The exhaust valve is gradually closed and the inlet valve open. The compressed air enters the booster cylinder. The brake valve is adjusted so that the compressed air begins to enter the cylinder after all clearances have been used up in the brake mechanisms and elastic pedal travel has begun. The air pressure on the booster piston increases the force with which the piston of the master cylinder act on the fluid.

As the pressure in the cavity beneath the diaphragm increases, the diaphragm bends and the intake valve reaches its seat. As soon as it is fully closed, the force acting on the diaphragm on both sides is balanced. The force applied to the brake pedal corresponds to a strictly defined air pressure in the booster cylinder. When this force is reduced, the diaphragm bends still further, opening the exhaust valve. The air pressure in the cavity beneath the diaphragm decreases in proportion to the decrease in force acting on the pedal.

If the pedal is fully released, all parts in the drive system return to their initial positions, and the air from the cylinder of the booster is exhausted into the atmosphere. This type of brake drive can also operate without a booster (when there is no compressed air available), but significantly more muscular energy is required of the driver.

We Are Answered

Engineer Captain V. Merkushev noted in his article "Universal Working Positions," in No 2 of this Journal for 1972 that the materials published in this Journal on the competition indicate the great experience accumulated in the creation of working positions of various types, and expressed the desire that this experience would be shared as widely as possible.

We have been told by the Chief of the Administration of Labor and Wages of USSR Defense Ministry employees, Colonel of Quarter Master Service A. Tishin, that the Administration is even now preparing to print an information letter with descriptions of a number of working positions equipped with the most efficient apparatus and highly evaluated by the contest jury.

A TECHNICAL DIAGNOSIS STAND

Colonel A. Rastegayev, O. Girya and V. Samoryadov pp 12-13

The process of checking the technical condition of motor vehicles, their units and systems can be accelerated, and objective data can be produced on their parameters using a technical diagnosis stand (Figure 1).

The welded frame of the stand consists of steel shapes. The frame carries a face panel, which is covered when the stand is not in operation. The face panel and frame carry all test and measurement devices, as well as a low frequency amplifier and a switching device. Here also is a dual-beam type S1-18 oscilloscope and a frequency spectral analyzer. The remaining devices are portable test instruments, designed to test the running gear and control units, and are stored in boxes in a bench.

The batteries, voltage regulators, generators and distributors are checked by an NIIAT E-5 device and a multiposition electrical equipment test mode switch. The operation of the remaining devices in the ignition system is checked by the voltage characteristics in the primary circuit, as indicated by the oscilloscope. The spark advance angle is checked using the second beam. To do this, electrical pulses are supplied by an induction sensor applied to the spark plug lead of the first cylinder.

The technical condition of crankshaft and connecting rod mechanism parts (wear of rings and pistons) is determined using a type GKF-6 gas meter on the basis of the quantity of spent gases entering the crankcase, the location and severity of any defects are tested by the NIIAT K-69 device, which tests the compression of the cylinders. This device can also be used to measure the clearance between valves and rockers as a function of temperature.

A TTsT-1 device using KhK thermocouples, can be used to determine the condition of the thermostat and the thickness of the scale layer on the walls of the water jacket of the cylinder head. To do this, the sensors are installed as follows: one, on the upper tank of the radiator, the other near the sparkplug aperture of the last cylinder.

The oil pressure in the main oil line is measured by a type EDMU-3 remote manometer, the indicator of which is installed on the face panel of the stand. Using a standard thermometer, oil pressure gauge and fuel level indicator, the operation of the engine is checked.

The quantity of carbon monoxide in the exhaust gases is determined by a type I-SO gas analyzer. A vacuum meter is used to measure the rarefaction in the intake manifold and determine the condition of the air cleaner.

Vibration measuring apparatus with an accuracy of 0.05-01 mm measures the vibrations transmitted to the crankcase to determine the clearances between parts of the engine and transmission: in the joints between rockers and valves, the crankshaft and bushing, the piston and cylinder liner, bearing clamps and balls (or rollers) and the driving and driven gears. The location of the defect and variation from nominal values can be established for each joint, regardless of the number of similar pairs.

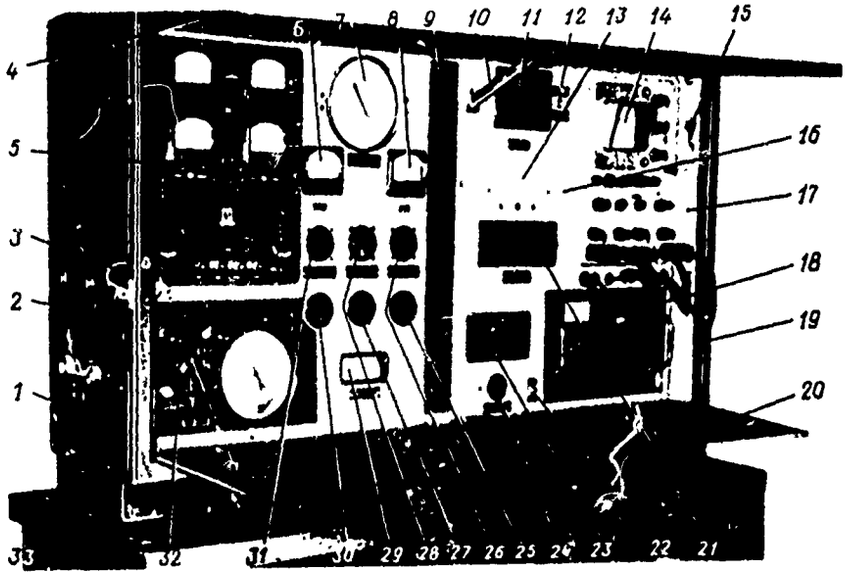


Figure 1. Diagnostic Stand:
1, body; 2, information input panel; 3, clamp; 4, 20, face panel covers; 5, NIIAT E-5 device; 6 an voltmeter; 7, vacuum meter; 9, fuel flor meter; 10, bracket; 11, tacho er; 12, 22, switches; 13, low frequency amplifier; 14, S1-18 oscilloscope; 15, clamp; 16, face panel; 17, frame; 18, frequency spectral analyzer; 19, cable; 21, I-SO gas analyzer; 23, test mode switch; 24, jack; 25, 27, 30, standard indicators showing fuel level in tanks, oil pressure in main oil line and temperature of cooling fluid; 26, engine head temperature gauge; 28, oil pressure gauge, 29, GKF-6 gas meter; 31, temperature sensor for upper radiator tank; 32, K-69 device; 33, bench.

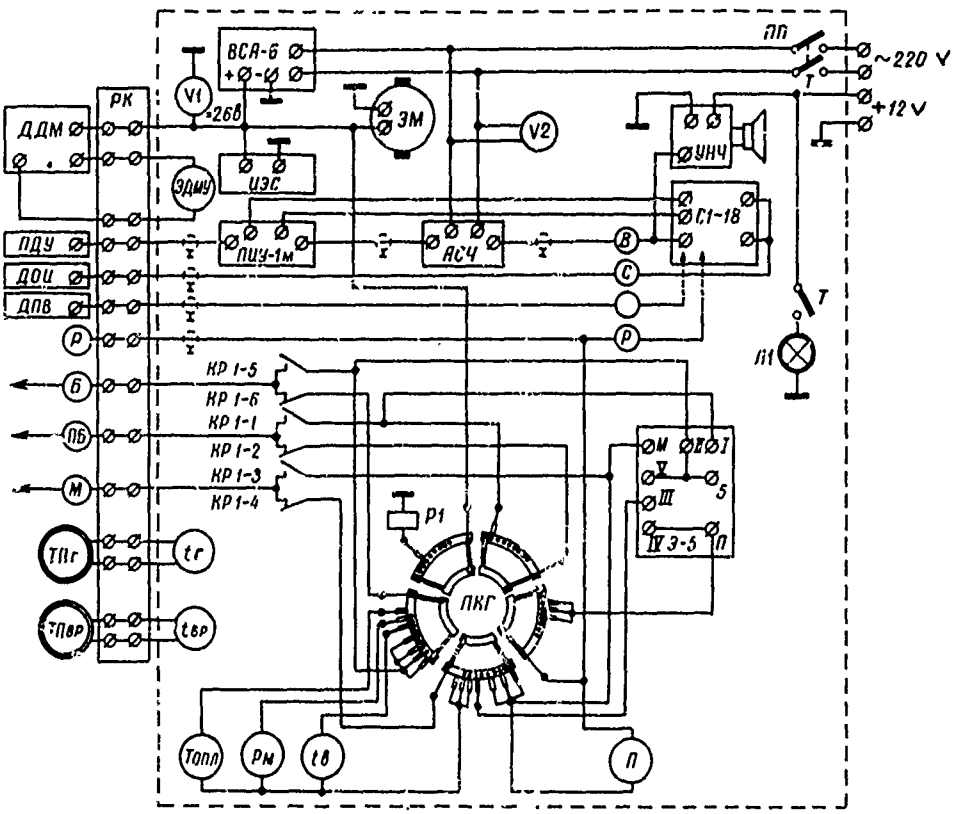


Figure 2. Electrical Schematic Diagram of Test Stand:
РК, distributor box with sensors; V1, V2, voltmeters; ИЭС, standard vibration signal imitator; ПИУ-1М, piezoelectric acceleration meter; АСЧ, frequency spectral analyzer; УНЧ, low frequency amplifier; п, tachometer.

Figure 3. Equipment of Mobile Diagnosis Station in Body of GAZ-69 Truck:
1, gasoline generator; 2, workbench; 3, rectifier; 4, diagnostic test stand; 5, compressed air cylinder.

The diagnostic information is transmitted from the vehicle being tested through a cable and hoses. The cable connects the electrical equipment being tested and vibration sensors, remote manometer, cooling fluid temperature gauge, oil pressure and fuel level gauges, as well as two thermocouples. The hoses transmit compressed air to the NIIAT K-69 device, crankcase gases from the engine being tested to the GKF-6 meter and clean air from the meter to the crankcase. One hose connects the intake manifold of the motor to the vacuum meter.

Before beginning measurements, the electric cable is connected through a distributing box to the devices in instruments being checked (Figure 2), installed on the units. The testing process consists of successive changing of the position of switch PKG and reading of the corresponding indications from the instruments.

The test stand is designed so that it can be easily installed in the body of the GAZ-69 truck (Figure 3). To support operation of the instruments in the field, the truck body also carries a gasoline generator type AB-1-0/230, a type VSA-6 selenium rectifier and a compressed air cylinder.

TANK REPAIR SHOPS

Engineer Lt. Col. A. Kovalevskiy, Engineer Lt. Col. V. Kaydalov pp 14-15

The tank repair shops (types TRM-A-70, EGSM-70, TRM-B-70 and PRZS-70) installed in ZIL-131 trucks have high cross country ability and are suitable for operations under all weather conditions at any time of year.

The equipment of the shops is placed in a type KM-157M van body, which differs from the KM-157 in that the sealing around the doors, windows and hatches is improved. Also, the walls and floors are covered with plastic rather than plywood. The body itself is shifted rearward, achieving better load distribution on the wheels of the truck. This allows the spare wheel

to be attached in its previous location, and eliminates the notch in the base of the body required for access to the fuel tank filler necks; to allow the shop to be installed within size limits "02-T," the slope of the roof is altered and height of the body is decreased by 50 mm. The length of the housing above the wheels is increased. The permanently attached entrance ladder is held up against the rear wall of the cabin in the travel position, and the lighting system of the body is modified.

Design changes have also been made in the basic equipment used in the shop. For example, plugs for connection of portable power supplies and consumers are installed on the main panel, increasing compactness and reliability of the electrical circuit. In the blocking system, the electromagnetic relay is replaced by a type RN-53/400 voltage relay, improving operating stability. In place of the AZOU-1 automatic circuit protector, there is a type AZOU-2 protector with two signal relays. The engine speed regulator uses a type SL-369G generator as the sensor (earlier, a type SL-369 was used). This allows more stable engine speed operation with the electric generator in use. The length of the cardan joints driving the power generators has been increased. The placement of tools and equipment in the workbenches has been modified. The benches are equipped with lists of tools and equipment they are to carry. The wooden boxes under the benches have been replaced with metal boxes. The shops are equipped with new, improved electric hand tools (set IE-6002) in place of the ED-12 electric drills and S-449A grinders.

The electrical equipment of the shops has also been modernized. The basic source of power in the TRM-A-70 and TRM-B-70 shops is a YeS-52-4M101 generator. It is driven from the transfer box of the vehicle through a single-speed power takeoff. The electromagnetic regulator maintaining motor speed constant as the load on the YeS-52-4M101 generator changes consists of the sensor of the regulator, an additional attachment and an electromagnet driving the accelerator. The function of the speed regulator sensor is performed by a dc generator with mixed excitation, type SL-369G. Its armature is connected to the shaft of the main generator by a belt drive, assuring that there is a direct dependence between the voltage developed by the regulator sensor and the operating speed of the motor. The voltage from the sensor is fed to the coil of the electromagnet which changes the setting of the accelerator pedal through a system of arms and levers and, changing the operating mode of the engine. An attachment with additional choke valves is installed between the carburetor and intake manifold, and the electromagnet of the regulator is installed on a special bracket between the cylinder banks of the engine. We note that the regular valves of the carburetor are fully opened when the supplementary regulator is being used.

The electric hand tools include an IE-2004 electric grinder and IE-1021 electric drill with a set of attachments. The drill can also be used for cutting of parts from sheet steel up to 2.5 mm thick, for removal of corrosion or old paint from metal surfaces, for driving or removing of nuts. These operations are performed using various attachments, the IK 8805 cutter and IK 8804 snipes, IK 8203 brush and IK 8406 and IK 8407 nut drivers. The first nut driver is designed for M8-M20 nuts, the second -- for M10-M24. The electric tools are powered by the IE-9401 frequency convertor.

Individual sets of universal tools (EKUP), special wrenches (EKSK) and mechanized hand tools, designed for assembly-dissembly and centering and adjustment operations during maintenance and repair of tanks, self-propelled artillery and track armored transporters, have been supplemented with new special tools and wrenches.

The electrical equipment of the shops consists of two panels -- the main and the lighting panels, as well as automatic protective devices -- breakers and blockers.

The main panel, installed on the right on the front inside wall of the body, carries a switch which connects the internal electric power consuming devices to the YeS-52-4M101 generator or to an external power supply, test instruments, breakers and switches. The rear wall of the panel carries cable and plug connectors, to which the external 220/380 v power supply and outside power consumers are connected through a hatch in the front wall of the body.

The automatic protective circuit breaker AZOU-2 instantly disconnects power consumers from power supplies if danger arises for servicing personnel, i.e., if there is a 22-24 v ac voltage between the body of the shop and ground, and also if a phase is shorted to ground or the resistance of the insulation of the phase conductors relative to the body decreases. The AZOU-2 is either connected between the YeS-52-4M101 generator and the main panel or between the external power supply and the shop. Since the unit is mounted in a separate section, it can be removed from the shop and connected to the external power line. This protects the crew in case of a failure of insulation in connecting cables, involving a short to the body of the shop or to ground.

The blocking device automatically stops the motor if its speed exceeds the maximum permissible speed with the electric generator connected. As the speed of the engine increases, the voltage of the generator increases to 270-280 v, causing voltage relay RM-52/400 to operate (disconnecting the ignition through additional relay MKU-48-0), stopping the motor.

The EGSM-70 electric welder power supply supplies the electric power for a dc welder and for devices requiring 220 and 36 v ac at 50 and 200 Hz respectively. It consists of the universal welding generator GD-304 (earlier, a GSO-300-5 was used), the YeS-52-4M101 ac generator, IE-9401 frequency convertor, reducer, cardan drive and electromagnetic engine speed controller.

One new device is the GD-304 universal welding generator. It is designed for single-post manual arc welding, cutting and surfacing of metals with metal electrodes, and also for semi-automatic welding of aluminum and aluminum alloys with consumable electrodes. The characteristics of the generator are presented in the Table.

The welding current can be changed in steps or smoothly. Smooth change is achieved by a remote rheostat. Five ranges of adjustment of welding current can be used for manual arc welding with the generator operating with a steeply

dipping characteristic: 250-350, 95-240, 45-110, 25-45 and 15-25 a. The proper range is selected using a 2-stage switch in the distributing device and the terminal bolts of the portable welders shield, fastened to the outside front wall of the body during travel.

When necessary, welding can be performed at other modes, when the generator operates with rigid characteristics. When this is done, the two stage switch on the distributor panel of the welding generator is set at one of two possible welding voltages: 16-25 or 25-40 v.

The equipment for argon arc welding allows parts of aluminum alloys 1-4 mm thick to be welded with tungsten electrodes, while consumable electrodes can be used to weld parts made of carbon and stainless steels, copper 3 mm and more thick, aluminum alloys 3-50 mm thick.

The PRM-4 220 v reverse polarity device included with the argon arc welding set is designed for welding under stationary and field conditions. It can weld parts of carbon and stainless steels, copper, aluminum and its alloys with considerable electrodes in a medium of argon.

This device consists of the mechanical equipment in a carrying bag and the equipment cabinet, mounted inside the shop. The mechanical equipment automatically feeds the wire and argon into the zone of the welding arc, the equipment cabinet controls the feed rate of the wire, switches the voltage of the circuit and opens the valve of the argon tank. The feed rate of the wire (from 100 to 800 m/hr) is regulated with a special rheostat fastened to the strap of the bag. The portable apparatus is switched by means of buttons mounted in the handle of the welder. These buttons are contacted in sequence by a single lever: first the button switching on the argon feed, then the button switching on the equipment cabinet.

Parameters	Values
Nominal welding current, a	300
Ratio of duration of operating period to cycle length, %	60
Cycle length, min	5
Operating voltage at nominal current, v	32
Nominal rotating speed, rpm	2,000
Nominal power, kw	9.6
Limits of adjustment of welding current for manual arc welding with steeply dipping characteristics, a	15-350
Limits of adjustment of voltage with semi-automatic welding using rigid characteristics, v	16-40
Limits of adjustment of welding current with semi-automatic welding, a	80-300
Idle voltage of generator adjusted to nominal mode, v	75-80
Weight of generator, kg	240

The welders have interchangeable parts, allowing welding of wires with various diameters (from 0.5 to 2.0 mm). For steel 0.5-1.2 mm in diameter, a small burner is used, for steel 1.6-2.0 mm in diameter, aluminum 1-2.0 mm in diameter and copper 1.2-2 mm in diameter -- the large wire is used. The maximum welding current using the large welder is 500 a, the small welder -- 200 a.

The electric valves and reducer installed on the argon cylinder are connected to the burner by a rubber hose and two-conductor cable, which in turn is connected to the external panel of the welder on the front wall of the body.

The argon (GOST 10157-62) is delivered in a 40 l capacity cylinder under a pressure of 150 atm. The gas cylinder weighs 78 kg full.

The shop contains a type ASM-1-58 medium pressure portable welder for oxyacetylene welding and cutting, with a productivity of 1.25 m^3/hr, and oxygen reducer, oxygen cylinder, welding head with a set of tips, oxyacetylene cutter, kerosene cutter and hoses with clamps. This equipment can be used for oxyacetylene welding of metals 0.5-30 mm thick and cutting of low carbon steel 3-300 mm thick.

The shop also has forging and copper and tin shop equipment and tools, as well as hand electrical tools. The electric hand tools include a device for repairing cracks in armor, the I-160 electric screwdriver, the IE-2004 electric grinder and IE-1021 electric drill, which has fittings including cutters and a wire brush (set IE-6002). The attachment for drilling cracks in armor consists of a stand with a plate and bracket which carries the IE-1017 electric drill. In operation, this device is fastened to the armor, the bracket plate is welded to the armor in four points. After completion of drilling, the welded spots are broken with a chisel and the attachment and plate are removed.

The PRES-70 mobile repair and charging unit is designed for repair, charging and testing of batteries under field conditions. The basic equipment includes a diesel powered battery charging generator type AZDS-20M. It consists of a diesel-electric generator type AD-10-P/115-C, three charging distributor devices (ZRU) and a control panel. The AZDS-20M power station differs from the earlier version in that its individual units are modernized and its service life is longer.

When the surrounding air temperature is low (+5°C or lower) the diesel motor of the station is started using a special heater with manual drive. We should note here that when the surrounding air temperature and cooling fluid temperature reach -20°C, the engine requires 14 minutes to start. During this time, the temperature of the cooling fluid rises to 65°, of the temperature of the oil -- to 80°C.

Each charging ZRU distributor device consists of a metal box with folding supports, a distributor panel and a section of rheostats. In the travel position, the ZRU is carried in the workbench storage slots, and during operation it is removed from the body and installed in a tent.

The station is also equipped with a D-4 still (replacing the D-1), producing 4-5 l/hr. It can be connected to 220 or 115 v power lines. When 115 v power is used, the device produces significantly less distilled water. The electrolyte or acid, and distilled water are stored in four polyethylene containers in a metal bracket, lined on the inside with acid resistant rubber.

All of the shops which we are discussing are equipped with a motor vehicle set designed for special treatment of DK-4 military equipment. This consists of a gas-liquid device, a set for degassing of weapons and equipment, individual chemical defense packets, decontaminating powder, a PET and fasteners.

The gas-liquid device allows decontamination, degassing and disinfection by the gas-liquid method (aqueous solutions of decontaminating powder are used), as well as decontamination of dry, oil-free surfaces by the vacuum cleaner method. Operation of the device is based on the use of heat and the kinetic energy of the exhaust gases from the motor of the vehicle.

The tank repair shop and repair and charging station include a field type DP-5A radiation meter, used to determine the beta-contamination of the surfaces of various objects and to measure the level of gamma-radiation.

Exhaust gases are led out through a special tube connected to the exhaust pipe.

The equipment used in the tank repair shops allow the main operations required for repair and servicing of armored equipment to be performed under field conditions.

THE STUDY OF TELEPHONE EQUIPMENT

Engineer Lt. Col. N. Sobolev pp 16-17

By the time they begin studying field telephone apparatus, specialists in radio and radio relay communications and combine telegraph and telephone communications equipment should have mastered the basics of the electrical equipment, should know the essence of the physical processes occurring in dc and ac electric circuits, the general design and operation of semi-conductor devices, should be familiar with electromagnetic induction and should be aquainted with acoustics.

Precise organization and capable design of drills on this subject are absolutely necessary for rapid mastery of telephone apparatus. Considering the requirements of the program for combat training, these drills, we believe, should be performed according to the following plan.

Theme: "The TA-57 Field Telephone Apparatus."

Training purpose: To study the tactical and technical data, general design and electrical diagram of a telephone apparatus, to master the basic rules for its use.

Time: 2 hours.

Location of drill: Classroom.

Materiel support: TA-57 telephone apparatus (one for each two or three trainees), models of the apparatus and its component parts, displays, diagrams, cable sections 1.5-2 m long, screwdrivers, artificial communication line, devices for measurement of voltages, currents and resistances.

Training aids: Technical description and instruction for operation of the TA-57 telephone apparatus, communications sergeants handbook (books 1 and 2), telephony textbook.

The introductory portion of the drill should be begun by announcing the theme, training purposes and problems to be studied. Then, test questions should be given to determine the preparation of the troops for the drill. For example, the following questions might be asked: What parameters characterize wire lines and how do they influence communications range? How do the impedences of a condensor and oil vary with ac frequency; what is the basic difference between LB and CB telephone apparatus?

The drill leader, in discussing the questions, should turn his attention to the accuracy of the concepts and definitions required to explain the theme of the day. Since the TA-57 field telephone apparatus is a universal type (LB-CB system), it is a good idea to recall the specific features of operation of wire communications systems when the microphones are powered by sources of current in the apparatus (LB system) and at central telephone exchanges (CB system).

Number	Problems Studied	Time, minutes
	Introduction	5
1.	Purpose and tactical-technical data of telephone apparatus	10
2.	Design of telephone apparatus	20
3.	Electrical circuit of apparatus	15
4.	Testing operation of apparatus	10
5.	Installation of apparatus, connection and testing of communications	15
6.	Basic rules for operation of apparatus	20
	Conclusion	5

Before going over to presentation of the first problem (see Table), the trainees should be reminded of the role of Russian and Soviet scientists in the development of domestic telephony. In particular, discuss the creation of the first series of multipole telephones in 1878 by Engineer P. M. Golubitskiy, the transmission of telegraph and telephone signals on one wire for the first time in the world by Captain G. G. Ignat'yev in 1881. This approach to the drill will make the students proud of the technical achievements of our country and will inspire them to study one of the latest models of field telephone apparatus, using semiconductor devices and printed circuits, more thoroughly.

In describing the tactical and technical data of the TA-57, particular emphasis should be given to the parameters allowing it to be used successfully under field conditions as part of mobile and stationary communications units. The equipment can be connected into CB systems and can be used for communications on radio relay lines. It has an inductive call and covers an attenuation of 5.5 nep, so that it can be connected to various cable lines. For example, it can provide communications over type P-271 cable for 120-150 km, over P-275 cable for 12-15 km, over PTF-7 cable from 40-80 km.

Using models of the apparatus, the removable block, upper panel, hand set and power supply, discuss their design. For example, the removable block is a plastic panel with a printed circuit on the lower side, which is a new feature in comparison to earlier types of telephone apparatus. The top side of the panel carries the parts of the talking and calling circuits of the apparatus, the coil, bell, PU (amplifier) switch and RP (lever) switch, transformers and chokes.

The leader should accompany his discussion of the operation of the small 2.2 w inductor which is the source of the calling current with demonstration of the parts involved on the model and figures (diagrams). He should turn the attention of the trainees to the operation of the shunting system of the inductor, consisting of three current-carrying springs. He should where the driving gear of the inductor has a slot for the pin pressed into the axis. He should then demonstrate how at the initial moment of rotation of the inductor crank, the axis rotates freely in the gear and the pin, sliding on the beveled surface of the gear, pushes the axis to the right, switching the springs and connecting the windings of the inductor into the line. Rotation of the armature causes an altering current to develop in the windings, the frequency of which depends on the speed of rotation. If the inductor crank is rotated three times per second, the frequency of the current is 15 Hz.

The upper panel is not only a cover for the removable block. The drill leader should demonstrate where it carries the three line terminals L1, L2 and K for connection of the apparatus to the line, as well as the positions for placement of the hand set and batteries. Here also, in depressions in the panel, are the apertures for the head of the mode switching screw PRR (LB-CB).

It is very important that the trainees understand the design and operation of the TA-57 hand set. They should be reminded of the general purpose of the microphone and telephone. Then emphasize: the TA-57 uses a DEMSh-1 as a microphone, a differential electromagnetic convertor transforming sound energy to electrical energy, with high noise resistance. This means that the sensitivity to distant sources of sounds is low. This property is very important for work in noisy rooms. Since the membrane of the microphone is opened for sound waves on both sides, it is more sensitive to sound waves radiated by a nearby source on one side of the membrane. Its maximum sensitivity is observed for sound sources located in the direction perpendicular to the membrane, the minimum sensitivity is for sources in the plane of the membrane.

Further, in studying the hand set, attention should be turned to the fact that the speaker used is a DEMK-6A high quality telephone electromagnetic capsule differential speaker. In contrast to ordinary electromagnetic speakers such as the TK-47, its membrane is not a portion of the magnetic circuit and is not directly subject to the influence of the magnetic flux. This allows the use of a thin, corrugated membrane of light metal, increasing its sensitivity and improving the characteristics of the speaker.

After giving the trainees time to inspect the apparatus at the working positions, the leader goes over to analysis of the electrical circuit. It must be stated at this point that the characteristics of the telephone apparatus and of telephone communications in general are significantly improved by the presence of a special three-stage amplifier consisting of semiconductor devices.

Experience has shown that it is most difficult for the trainees to master the operation of the local attenuator, protecting the telephone from the voice currents produced in the telephone itself. In order to facilitate understanding of the principle of operation of this circuit, explanations should be begun by repeating the principle of operation of the electrical bridge, after which the bridge circuit of the apparatus can be studied. In the TA-57 telephone apparatus, two arms of the bridge serve as secondary windings for the output transformer, two others -- as the external communications line and balancing circuit. The speaker is connected to the zero branch. For greater clarity, it is expedient to use the diagram of this section of the apparatus shown separately, with all the elements included in this section.

Speaking of the purpose and operation of the balancing circuit, particular attention should be turned to the fact that it is designed to operate only with type P-247M cable. If field cable of other types is used, in a special device is included in the apparatus to assure the required noise resistance. The operation of the local circuit and balancing circuit will be well understood by the trainees if a model telephone apparatus is available in the classroom, connected to an artificial communications line, and the balancing circuit in the model telephone has variable characteristics (in place of the circuit included in the apparatus).

The second hour of the drill should be begun by studying the basic rules for checking the operation of the apparatus, its installation and connection. This portion of the drill can be constructed so that after the leader explains a given operation and illustrates its performance, the trainees can do it themselves. The order in which they perform the checks and the correctness of the results they achieve should be observed carefully by the leader.

After an apparatus has been checked, it must be connected to the line. The trainees are given additional wires for this purpose and the necessary tools, after which each one performs this operation under the supervision of the drill leader. The telephone equipment on neighboring tables is connected in pairs. The trainees attention must be turned to the fact that the operating mode switch (PRR) must be set in the proper position when this is done. After connecting the equipment, the trainees check the transmission of a call and a conversation. It is important to begin proper calling of a subscriber and proper conversation techniques immediately.

Approximately half of the second hour of the drill is dedicated to studying and mastering the basic rules for operation and servicing of the telephone equipment. Experience has shown that when these problems are studied it is necessary to see that the trainees master the necessary minimum

rules. First of all, they must know that when the apparatus is connected to an LB-system exchange with remote control of the operation of the radio set, the mode switch (PRR) should be in the LB position, while when it is connected to a CB system exchange must be in the CB position. To talk, the talk button on the hand set must be pressed. During conversations, the microphone must be held near the mouth (to the side), the speaker must be pressed tightly against the ear. If audibility is poor, the PU button should be pressed and the talk button released. This connects a special receiving amplifier into the line, increasing the communications range by 30-35%.

All trainees must learn the rules for caring for the equipment. The leader should emphasize how important it is to maintain the equipment clean. To do this, it is recommended that the outer surface of the box, hand set and upper panel be systematically cleaned of dirt and dust. Cleaning with dissembly is performed only when necessary. As a rule, only the upper panel of the apparatus is removed and the hand set open. These areas must be carefully cleaned in order not to damage the printed circuits. Dirt and dust can be removed from parts inside the apparatus and hand set only with a soft brush or rag. The men must be cautioned against excessive care as well: frequent openings and cleanings shorten the service life of the apparatus and its parts.

In conclusion, the leader checks the mastery of the material by test questions, requiring oral answers and practical operations. Correct answers and capable performance of operations indicate that the theme has been mastered.

This plan for a drill on the TA-57 field telephone apparatus can be used to train most specialists in communications Podrazdeleniye. Naturally, the time set aside to study the theme may be changed considering the specific conditions and tasks before the various specialists.

RADIO SET WITH UNDAMPING OSCILLATIONS

Unsigned p 17

On 30 June, 1919, V. I. Lenin signed an order by the Council for Workers and Peasants Defense concerning the construction of a powerful radio station in Moscow, capable of maintaining constant and reliable communications between the center of the country and the outer regions, as well as the western states. Based on this order, in 1920 a radio station with undamped oscillations was constructed in Shabolovk, using an arc generator. At first, the station used a medium power transmitter (25 kw) with an antenna on two wooden masts.

In early 1922, an arc transmitter with a power of 100 kw was installed at the radio station. Alongside the wooden antenna masts, using a plan and under the leadership of the great Russian Engineer, later honored Academician, V. G. Shukhov, a metal free-standing tower 160 m in height was constructed. Operation of the new transmittor and an antenna suspended from Shukhov's tower was begun on 19 March, 1922. The transmissions of the Shabolovsk radio station, due to its high power and high antenna, could be heard not only in the remotest corners of the Soviet Union, but throughout Europe.

In 1927, the Nizhegorod Laboratory installed in a new high power radio station ("new comintern") at Shabolovk. The generator of this station had three stages of amplification. The final stage included three water-cooled tubes with nominal power ratings of 25 kw each. The modulator also consisted of three stages based on 25 kw tubes. After it was put in operation, the central broadcasting station of the Soviet Union continued to be the most powerful in Europe.

TECHNICAL TRAINING AT THE AIRFIELD

Engineer Lt. Col. V. Filimonov p 18

In order to operate aviation combat equipment correctly and, consequently, successfully, each flier, technician and mechanic must have a great reserve of theoretical knowledge, and firm skills in operation with the equipment. Furthermore, the knowledge and skills accumulated must be improved, since equipment is becoming evermore complex and methods of its servicing are developing.

This task, like everything else related to military service, is not easy; however, it is being solved quite successfully. This is indicated by the continuous improvement of the operation of aviation equipment, the increased class ratings of specialists, reduction in times required to prepare aircraft for flights. All of this is achieved by precisely and intelligently organized technical training and, in particular, effective utilization of time, application of those forms and methods of training which are called for in the applicable documents (periodical assemblies of specialists, drills on Commanders training days, independent training during service time, etc.).

However, for some specialists the time set aside is not always sufficient. Then, the necessity arises of finding time for supplementary drills, for example for improvement of skills in utilization of technical diagnostic equipment, for studying various improvements in the design of aircraft or problems, the knowledge of which is necessary to pass class rating tests. How can this time be found? Various answers can be given to this question.

For example, training is frequently performed on days when, for some reason, flights have been cancelled. However, in this case training cannot always be efficiently organized, since the decision to cancel flights is frequently made only a few hours before they were to begin. This means that all personnel, regardless of whether flights are held or not, must prepare for them, working at the airfield. In order to transfer from this work to drills on technical training, the working positions must be cleared, aircraft

covered and, finally, the men must re-orient themselves psychologically, switching their attention from preparation of the equipment to its study.

Independent training on additional themes require precisely organized testing, which requires considerable time in preparation.

Many engineers find this time: they give their subordinates individual assignments and check their performance during class rating tests and during inspection of the equipment on preliminary preparation days. This is obviously correct. Experience has shown that this checking allows the knowledge of a technician or a mechanic to be tested directly at his working location, utilizing errors in grading.

There is yet another reserve area of time which we feel is worthy of attention, which can be used for technical training of the aviation specialists. We are speaking of half hour drills at the beginning of each day of preliminary preparation of the equipment for flights.

30 minutes. At first glance, it seems like little. Actually, it is not much in the total balance of time set aside for preparation of the aircraft. However, it is enough, if it is used for regular training. This can easily be confirmed by calculation. If ten days are set aside each month for preliminary preparation, five hours will be made available for training in this manner. Each year -- 60 hours. If properly organized, the volume of knowledge of each specialist in the aviation engineering service (IAS) will expand continually. This calculation has been confirmed by the practice of many Podrazdeleniyes.

...The day of preliminary preparation. The engineering and technical personnel of the Podrazdeleniye, arriving at the parking location, are sent to the classroom. Diagrams have already been set up, models of equipment and other training aids put in place. The serivce chief or some other specialist assigned and prepared for the drill in advance names the theme which will be studied during the next half hour (for example: "the altimeter. Its design and operation of the aircraft") and briefly discusses its content. He then begins questioning the men.

Questioning follows a simple plan: Question -- answer -- correction of answer. The questions are generally purely of an applied nature, but cannot be answered without knowledge of the design and operating principle of the unit.

For example, in studying the barometric altimeter, the following questions are usually given -- the situation: "the indications of the altimeter installed in the cockpit of an aircraft differ from the indications of the KPU-3 by more than the permissible amount, according to the technical conditions. Why? What would you do?"; "the pilot has reported that as he took off, the needle on the altimeter indicated a negative altitude. Why?"

The specialists are eager to answer these questions. First of all, because each question relates to their sphere of activity and its proper understanding will make it easier to seek out possible defects, increasing their confidence in the equipment. Secondly, the specialist knows that he is not answering in order to get a grade recorded, and a possible mistake will not result in personal criticism. Quite the contrary: an error forces all of the participants in the drill to think and suggests their own possible answers.

The role of the drill leader in this case is that of a sort of director: he directs the discussion, if it arises, and prevents it from being distracted. Most importantly, he sums up the discussions, clarifying the conclusions of his students.

Can all of this be done in 30 minutes? Experience indicates that it can. Of course, this requires some training. The efficient type of answer, brief but exhaustive, must be developed.

Which of these versions is most acceptable? There can be no unambiguous answer. Everything depends on the situation. If intensive flights are being conducted, independent training is best. When there are no flights, days of technical training should be organized.

Another difficulty involved in organizing technical training of the personnel of a squadron is that the specialists generally have different levels of practical training. The aircraft technicians include veterans and new men, just arrived for work. The former have experience and theoretical knowledge, basically related to practical problems. The latter, in contrast, have very little practical experience and good knowledge of the most general rules of aviation science. The same can be said of specialists in other services.

This requires a differentiated approach to the training of each technician and mechanic. For high rated specialists, the purpose of training must be improvement of their knowledge and skills, polishing of their mastery. For beginning specialists, the purpose must be different: study and practical mastery of methods of work on the equipment, consideration of typical indications of abnormal operation.

There is much to say in favor of creation of groups of approximately the same level of training: the smaller the group, and the more homogeneous its composition, the more rapidly and properly the program will be mastered.

However, each group needs a leader -- for classroom drills, drills on the equipment, and for independent training. To overcome this difficulty, the number of groups must equal the number of people who can be used as drill leaders.

Speaking of the peculiarities of the organization of training of aviators, we must mention the fact that each man, particularly specialists on aircraft or engines, must study many disciplines. And they must not merely

become generally familiar with them, but must study them deeply, in order to be able to prepare the equipment for flights well. An aircraft technician must check how well his equipment has been prepared by specialists of all services. This testing is impossible without the corresponding knowledge.

Considering this, engineers must carefully think out the themes of drills with each group. Many drills must be performed directly on the equipment, so that each specialist will see an remember not only the location of the elements to be checked during preparation of an aircraft, but the points on the elements where deviations from the norm may occur.

As we can see, training can be organized under the conditions at an airfield. We believe that the experience which we have described proves this.

TRAINING OF UNDERWATER TELEVISION OPERATORS

Lt. Commander V. Sukhartsev p 19

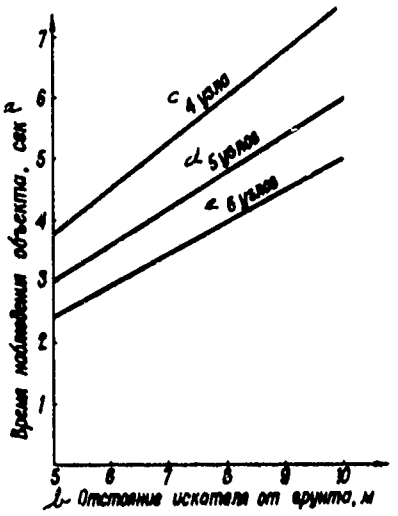
The activity and reliability of an underwater television operator are determined by a large number of different factors. Among the most important of these are the peculiarities of the dynamics of the search process, conditions of the external medium (vibrations, noise, rolling, air temperature drop), design peculiarities of the television system, the physiological capabilities and degree of training of the operator himself, the quantity of information which he receives and methods of its presentation, the shortage of time and the importance of decisions.

The task of the operator is to observe the appearance of certain signals (either an image of an object or a sharp change in depth according to the indications of the sonar), to make a decision and act in correspondence with these signals. The reasons for errors in his operation are that the operator, loaded with signals, frequently fails to react to some of them or reacts incorrectly, so that he misses the object of his search or performs television search at too great a depth.

Operators serving the control panel of the depressor are under the greatest stress. If the required separation from the bottom is not strictly maintained, the width of the search zone is decreased and gaps appear between neighboring zones. Operators at the video control devices also must work under time-shortage conditions with intensive information flows. As long experience has shown, from the moment of appearance of an image of any object on the screen to the moment of its recognition, 3 to 4 seconds will pass. This minimum time must be used as a basis both in preliminary calculations and in the selection of the optimal speed (see Figure).

Since the operator of the depressor control panel must hold the fixed separation from the bottom quite precisely, it is very important to establish the separation correctly, determined by the transparency of the water. Therefore, preliminary calculations require a knowledge of the transparency of the water in the search zone. Ships armed with television search equipment must

carry tables with information on water transparency in various regions and must systematically refine these tables using the information of the Hydrographic Administration, or the results of measurements performed by the personnel of ships passing through the region. The optimal selection of travel depth for the search equipment improves the operating conditions of the operator and reduces the number of errors. There are other possibilities for increasing the quality of his work. As experience has shown, the control panel operator usually becomes fatigued more rapidly than the video control device operator; therefore, they should be periodically interchanged, and watch length should be set efficiently (see Table).



Key: a, time of observation of an object, sec; b, distance of search equipment from bottom, m; c, 4 knots; d, 5 knots; e, 6 knots.

Temperature in room, °C	Watch length, hours	
	Depressor control	Video control
up to 20	4	6
20-30	3	4
30-40	2	2

Video control operators working under time-shortage conditions frequently record not objects searched for, but rather various interference bodies. Interference bodies are most frequently recorded when observed at the edges of

the screen or when the observation time is to brief (1 to 2 seconds). In order to reduce the number of errors of this type, it is necessary first of all to determine and hold the proper search speed so that the observation time is no less than 3 to 4 seconds and, secondly, operators must be constantly trained on the trainer. The effectiveness of these training exercises has been clearly confirmed by the experience of the Red Banner Northern Fleet.

The trainer used for this purpose is a control panel with video control devices. A projector is used to focus images of bottom sectors on the screen for 2 to 6 seconds, moving at 2-3 m/sec, corresponding to 4 to 6 knots. Various bottom sectors have intereference bodies and objects of search, the position of which on the bottom varies widely. Training of young operators on the trainer help them to develop visual memory, and improves their skills in recognition of objects. These exercises increase the operators accuracy of search, the number of interference bodies which he marks will be divided to half, the number of reloads of recognition bouy cassettes is also halved, correspondingly decreasing search time. It can be reliably stated that the development of young specialists in this case is significantly accelerated. Yet another factor confirms the advantage of this method of training: ship motor operation is reduced.

The work of underwater television operators require highly developed skills and high stress. Therefore, we believe that training can never be committed to one single method, even the most effective.

Furthermore, operators must be selected according to their personal qualities, knowledge and professionally significant skills and abilities. Special training sessions on trainers under conditions approximating true operating conditions should make up an important part of their training. In our opinion, searches at sea must be planned regularly, at first in simple situations, then under long search conditions (12 hours and more), and also when waves are high, with sharp changes in temperature, with currents (1.5-2.0 knots), with low bottom illumination, high complexity of the region, sharp changes in depth (up to 5 m), under which it is necessary to struggle to maintain the weapons and technical equipment.

An important component part of operator training is detailed study of possible defects of the equipment, particularly those causing poor image quality. The reason for this defect might be improper setting of the optical systems and transmitting television cameras, failure to observe nominal voltages in power supply units. All of this causes the image on the screen to be washed out and of poor contrast. As a result, the width of the search zone is decreased and its effectiveness is reduced. Sometimes, as the television system is being adjusted, the operators, attempting to produce a large, precise image, accidentally increase the scale and thus decrease the maximum possible area of inspection.

As we can see the effectiveness of search can be reduced not only by the operator, but by specialists operating various items of technical television search equipment. This type of error must be eliminated by persistent and planned training and indoctrination of the specialists.

Search crews should be made up considering the level of training and physical capabilities of the operators. Only then can high reliability and continually increasing mastery be achieved.

CLASSROOM FOR STUDYING RADIO EQUIPMENT

Engineer Colonel A. Merkin p 20

One means for activating the process of learning is the use of technical training equipment which supplements and expands the traditional methods of training. This equipment includes teaching machines, operating models, stands and trainers.

The effectiveness of the use of such equipment has been confirmed by the experience and the results of training of students at the Saratov Higher Military Chemical Command School. This school includes several automated classrooms. One is used to study electrical and radio equipment.

The room contains 24 teaching machines (one for each student) and a demonstration stand, which is also the control panel for the teacher.

The front panel of each machine (Figure 1) carries an "on-off" switch, a knob for the "answers to questions I-V" switch, labels with code numbers, a display panel indicating "answer question number ...," an electric measuring device "grade of answer," and a "ready!" switch.

The teaching machines are connected to the demonstration stand by nine-conductor cables, running beneath the floor of the room. The stand (Figure 2) carries a display showing the numbers of working positions and indicating "ready to answer," five rows of "error" display lights and the power supply switches.

The electrical circuit of one working position is shown on Figure 3. There are five double-plate synchronous "answer" switches with five positions each. The outputs of one plate (except for the "off" position) are connected to the terminals of the "code" plug, which can be reached through the rear portion of the body of the device. The leads of the second plate are connected to the "answer to question" light display, lamp L1 of which illuminates the title, while lamps L2-L5 show the question numbers.

The spring terminals of the "code" matrix of each switch are connected with four leads in a sequence determined by the program: a lead connected with a resistor to the terminal with the proper answer, three other leads to the other terminals in any sequence. These conductors are connected to the lamp in the "error" display on the demonstration stand.

The second leads of the resistors are connected to a microammeter, the scale of which is divided into five sectors, marked (left to right): "v. poor," "poor," "satisfactory," "good," and "excellent."

The circuit is powered by two six-volt batteries, powering the illumination and measuring circuits. The power supply circuit includes three switches, initially in the "off" position.

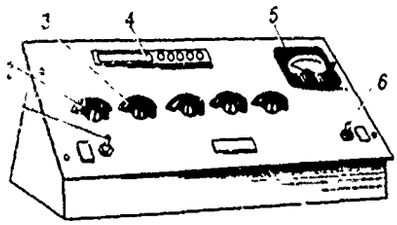


Figure 1. Front Panel of Machine: 1, switch; 2, "answer questions I-V" knob; 3, plates with code numbers; 4, "answer question number..." indicator; 5, "grade" electric measuring device; 6, "ready!" switch.

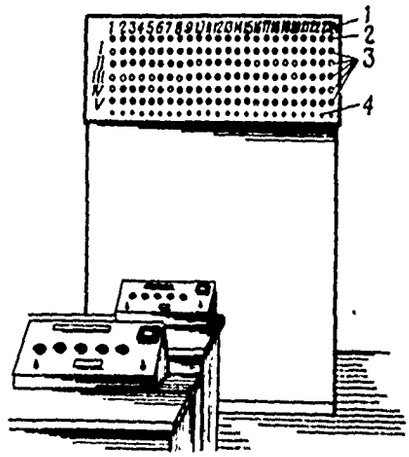


Figure 2. Demonstration Stand: 1, display of numbers of working positions; 2, "ready to answer" display; 3, rows of "error" display lights; 4, power switches.

The system operates as follows. A student, after receiving his question sheet and looking it over, moves the "on-off" switch into the "on" position. The display then lights up "answer question number one." The answer is input to the machine by setting switch one in one of its four positions. If the answer is correct (number on switch corresponds with code number), resistor R1 will be connected into the circuit with the microammeter. In case of incorrect answer, lamp L8 will light up on the demonstration stand.

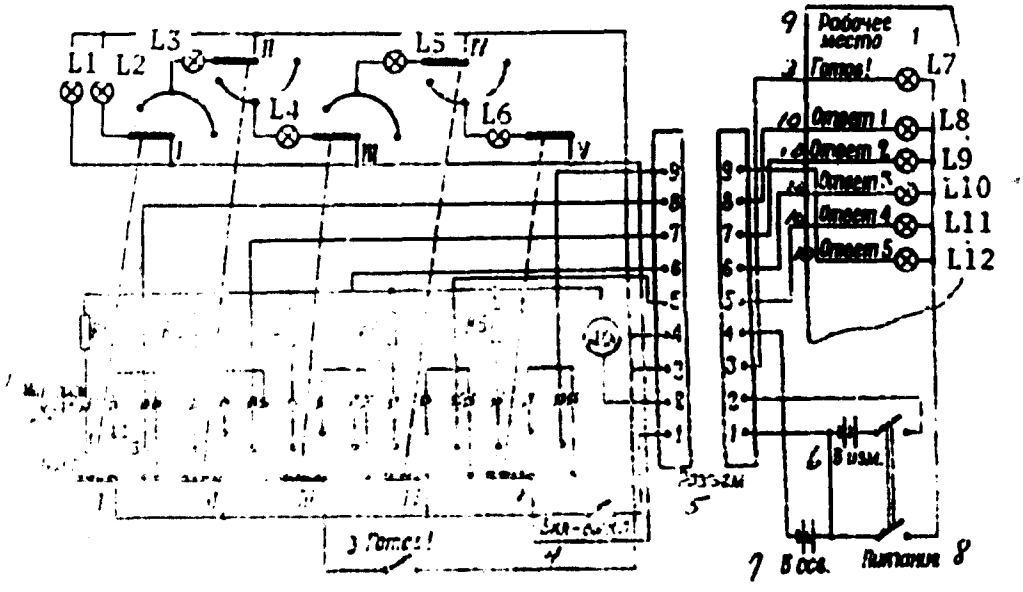


Figure 3. Electrical Diagram of a Working Position:
Key: 1, [illegible] matrix; 2, off; 3, ready!; 4, on-off; 5, plug; 6, b. meas; 7, b. ill; 8, power; 9, working position; 10, answer.

The movement of switch 1 and answer to the first question causes the number "2" on the "answer question number..." display to light up, and so forth until answers are given to all five questions.

Each subsequent correct answer causes an additional resistor to be connected in parallel to resistor R1. Since they are calibrated, the total resistance of the circuit with the microammeter decreases, and the electric current increases in proportion to the number of correct answers.

When he has completed his program, the student turns on the "ready!" switch. The red lamp on the display panel corresponding to his working position lights up. This indicates to the drill leader that the "power" switch should be turned on.

If correct answers are given to all five questions in the program, the microammeter will move to the position corresponding "excellent."

Electric lamps L8-L12 on the demonstration stand show the numbers of questions which were answered incorrectly.

Using the number of lamps burning, the teacher evaluates the answer, then turns off the power supply switch.

The system is very simple and inexpensive.

The schedule for use of the classroom is prepared during organization of drills and handed out to the teachers.

As they arrive for drills, the teachers question the students. Once a group of students has used the classroom 2 to 3 times, questioning can be completed in 7 to 10 minutes.

Use of these classrooms requires that some effort be expended in servicing the teaching equipment, recoding it, and composition of test cards. However, these expenditures are justified by better grades achieved by the students.

THE ELECTRIC MOTOR UNDER POWER

Engineer Lt. Col. V. Kutyrev p 21

The Army and Navy use a great deal of equipment which consumes electric power. The personnel must most frequently deal with electric motors.

Depending on the operating conditions, the following types of electric motors are used: open, closed and explosion-protected. Electric motors operating in a normal medium are generally open. Wherever dust or substances which could damage the insulation might enter the motor, closed motors must be used.

In all cases, the windings and current carrying parts must be protected from oil, water and foreign objects. Electric motors and drive mechanisms carry arrows indicating the direction of rotation and starting and control devices have the "start" and "stop" positions marked.

Breakers, magnetic starters, knife switches and starter control devices as well as fuses should carry inscriptions indicating which motor they control. This greatly facilitates operations and increases the safety of servicing.

In order to avoid touching bear wires and current-carrying parts, the leads of windings, electric motors and rotating parts are covered with guards. It is categorically forbidden to remove these guards when the machines are in operation. It is recommended that these guards be painted in bright colors, different from the colors of other equipment.

One of the main requirements of the electric safety rules must be strictly observed: ground the bodies of electric motors and starting equipment reliably.

The requirements of the electrical safety rules must be particularly well known and precisely observed by persons who supervise the operation or

service electric motors. Only specialists with at least group three qualifications on electric safety rules can open the doors of control panels, starting devices and other equipment independently, and only while strictly observing the safety rules.

During operation, servicing personnel and care for brushes and contact rings on operating electric motors. Servicing personnel must be careful in these cases not to let loose clothing or wrapping material contact the rotating parts of the machines.

It is forbidden to touch current carrying parts of different polarities, different phases or current carrying and grounded parts of machines simultaneously.

Turning of collectors or grinding of rotor rings can be performed with the machine rotating only at low speed and with protective glasses.

Servicing personnel must know that an electric conductor must be immediately disconnected from the power line in case of accident (or threat of an accident), appearance of smoke or flames in the electric motor or starting and control apparatus, vibrations above permissible norms, threatening the integrity of the installation, breakage of a drive mechanism, heating of bearings above the permissible temperature, significant slowing of motors, accompanied by rapid heating of the installation.

In no case can operations be performed on operating machines in order to save time. Warning signs saying "do not turn on -- men at work" must be placed on control switches, breakers and knife switches.

Entries must be made in repair journals stating the reasons electrical equipment were shut off -- for what operations and on whose orders. The warning can be removed and installation turned on only after an entry has been made in the journal indicating completion of work and the responsible person who reported completion of work.

It is very important to know the requirements placed on cable nets, as well as the rules for working with them. These nets must not have damaged insulation, cracks, cuts or breaks. The Commanders of Podrazdeleniye responsible for electric motors must take measures to replace damaged cable lengths. Sagging or broken wires, damaged insulation -- these may result in injury.

The safety rules forbid deploying, tearing down or changing cable lines when they carry voltage.

Personnel who have mastered the rules for operation of motors, who know and follow the safety rules, always make the proper decision in a difficult, emergency situation.

SUMMER CARE FOR WEAPONS

Engineer Major L. Vilinov p 21

Summer -- a time of exercises, marches, combat firing, performed in all types of weather and all times of day. During this period, particular attention must be given to servicing personal weapons. Before each trip into the field, the rifles must be inspected, cleaned and lubricated. During rainy weather, the wooden parts of the weapons, if the varnish coating is damaged, should be rubbed with a rag lightly wet with liquid gun oil, to prevent the penetration of moisture into the wood and possible warping.

After a rain, or a sharp change in air temperature, the covers must be removed from the weapons, they must be dissembled, inspected and all parts must be rubbed dry. It is very important to remove moisture from barrels, gas tubes, magazines and clips. Experience teaches us that if the barrel covers are not removed during cleaning, for example from the RPG-2 mortor, rust may form on the outer surface of the barrel, causing cracks. If rust appears, the damaged place should be wet with white spirit or kerosene, the rust removed with a rag and the part dried, then allowed to air for 20-30 minutes. In some cases, rust can be removed from unchromed surfaces with charcoal powder mixed with liquid gun oil.

When the weapons are being cleaned, the condition of the coatings on the parts of sights must be checked, and shiny placed repainted. There are many methods of painting these parts. Re-ently, the method of painting with BF-4 varnish with alcohol-soluble nigrosine has become popular (15-20 g nigrosine to 300-400 g BF-4 varnish).

Before firing, the barrel must be cleaned, but first the cleaning rags must be themselves cleaned of dirt and sand. Also, if, for example, AKM and RPK machine guns are cleaned, their magazines must be carefully inspected and, when necessary, dissembled and all parts cleaned. The problem is that firing a weapon lubricated with a thick layer of lubricant or covered with dust may cause the bolt frame or bolt to stop too soon.

After firing, the weapon must be carefully cleaned and lubricated. The barrel channels and other parts exposed to powder gases are best cleaned with RChS solution. However, remember that when the air temperature is high, RChS solution must be protected from excessive heating, since it decomposes at temperatures over 50°C and becomes unuseable.

Before firing, one should also inspect cartridges, clean them of dust and oxide and remove moisture from them. During exercises and firing, protect them from direct exposure to sunlight.

MARINE DIESELS IN THE NORTHERN LATITUDES

Candidate of Technical Sciences I. Gol'traf pp 22-23

The operation of marine diesels in the northern latitudes has a number of peculiarities which must be considered. Whereas in the southern latitudes, significant thermal overloads of the main parts[1] may occur, in the northern latitudes the thermal loads are lower than under normal climatic conditions. However, the maximum pressure in the cylinders and the pressure rise rate increase significantly. The reasons for this are the low temperatures of air and cooling water. If this factor is not considered during cruises in arctic and anarctic latitudes, the main parts of the engines may be overloaded.

The outside air temperatures encountered in operation may reach -30 to -35°C in northern waters, while the water temperature approaches zero. Of course, we must consider that air with this low temperature will reach the compressor of a marine diesel only when independently fed. If the air reaches the compressor from the machine room, it will be heated, more strongly the lower its initial temperature, the less the volume of the machine room, the higher the stress and more severe the operating mode of the mechanisms operating in the room. For example, in a ship with M503 diesels operating at maximum power, the air temperature at the input to the compressor with an external temperature of -1 or +14°C will be increased by 18 and 9°C respectively.

Consequently, when the air is fed to the compressor from the machine section, the influence of the low temperature of the outside air on the operation of the diesel is reduced somewhat. Still, this is insufficient, if we consider that this example related to mechanisms operating at maximum capacity with a small machine section, and outside air temperatures not extremely low.

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[1] See the article "Diesels in the Southern Latitudes," Tekhnika i Vooruzheniye, No 8, 1971.

The change in temperature and pressure of air in the engine is a function of its temperature at the input to the compressor may be significant, particularly in highly supercharged diesels. In the type 40D diesel as the air temperature at the input drops from 20°C to -20°C, the air pressure beyond the compressor increases by 1.12 times, the air temperature decreases by 1.75 times (Figure 1).

The increase in supercharged air pressure increases the maximum combustion pressure directly. The dependence of maximum combustion temperature and pressure rise rate on injected air temperature is more complex. The lower the temperature of the air injected, the greater the delay period of ignition of the fuel, the more rapidly the combustion process occurs, the higher the maximum combustion temperature and the greater the pressure rise rate. The increase in the delay period of fuel ignition causes the diesel to operate poorly at low loads and makes it more difficult to start, particularly for supercharged diesels. Low temperatures of the cooling water have approximately the same influence on the diesel when the supercharged air is cooled.

If it is simple to check the thermal loads on a diesel by measuring the temperature of the exhaust gases at the cylinders or before the turbine, checking of the maximum combustion pressure is possible only for diesels which have indicator valves. Even in this case, measurement of the pressure and making of the diagram are quite difficult.

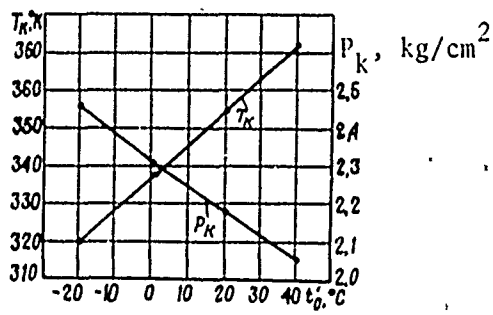


Figure 1. Temperature T_k and Pressure P_k of Injected Air at Output of Compressor as Functions of Air Temperature at Input t'_0.

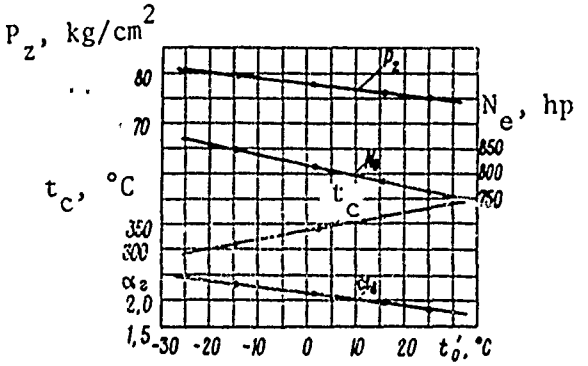


Figure 2. Maximum Combustion Pressure P_z, Temperature of Exhaust Gases at Cylinders t_c, Excess Air Factor During Combustion a_g and Maximum Power N_e as Functions of Air Temperature and Input to the Compressor of a 3D100 Diesel Generator at Constant Operating Speed and Fuel Feed.

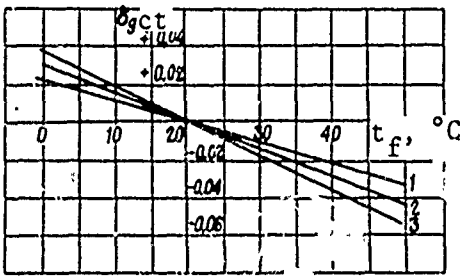


Figure 3. Relative Change in [illegible] Feed $\delta_{g_{ct}}$ as a Function of Temperature t_f with Fuel Pump Gear Against Stop and Full (Maximum) Operating Speed:
1, type 61 diesel; 2, type M50F diesel; 3, type M503 diesel.

At low temperatures of air and water at the input to the engine, the delivery of the compressor increases significantly, the excess air factor increases and, under certain conditions, the maximum power which the diesel can develop with the fuel pump gear fully against the stop increases as well. The excess air factor increases not only due to the increase in delivery of the compressor, but also due to the sharp reduction in absolute moisture content of the air at low temperatures.

For example, in a 3D100 diesel as the air temperature drops to -30°C, the maximum combustion pressure increases by 8%, the excess air factor and power increase by 26.3 and 5.6% respectively (Figure 2). We must emphasize that the 3D100 diesel is an unforced operating process diesel. In forced diesels, these changes are even greater. For example, when the air temperature at the intake drops to -20°C for a type 40D diesel, the maximum combustion pressure increases by 20%. Since the maximum combustion pressure in forced diesels with normal air temperature at the input, 20°C, reaches 100-120 kg/cm^2, it is obvious that the increase in the maximum combustion pressure can be dangerous, and must be considered in operation.

The maximum power which the diesel can develop with the fuel lever on full is significantly influenced by the temperature of the fuel as opposed to its normal value, 20°C.

The fuel temperature depends on the way the fuel is stored on the ship. If the fuel tanks are built as a unit with the hull of the ship, the fuel temperature will be approximately equal to the temperature of the water outside the ship. In separate tanks, the fuel temperature is somewhat higher than the temperature of the water and may approximate the temperature of the air surrounding them.

When a diesel operates at full (maximum) speed and the fuel lever is fully open, the maximum fuel feed at low temperatures (below 20°C) increases. In various diesels, the change in fuel feed differs (Figure 3). For example, in an M503 diesel, this change is almost double the change in a type 61 diesel. This results from the type of throttling of the fuel in the filler apertures of the plunger bushing, the geometric relationships of plunger pairs and clearances in the plunger-bushing pair, which differ in different types of pumps. It should be kept in mind that the influence of a change in fuel temperature on its feed rate must be considered only when the diesel operates with the fuel lever wide open.

At low air temperatures and water temperatures, with the hull of the ship and the screws in their normal condition, the diesel should develop its specification power before the fuel lever is opened fully, i.e., when there is a clearance between the fuel lever and the stop. As the condition of the surface of the ships hull and screws deteriorates (growths, dents, warping) and also with increases in wave action, the diesel may exceed specification power at normal or even reduced revolutions. Under these conditions, the mechanical loads increase on the parts of the diesel and the parts transmitting the torque to the screws. Gas temperatures lower than normal, observed during cruises in the northern latitudes, may confuse the personnel concerning the mechanical loads on the diesel. To avoid this, we have pre-

sented a detailed explanation of the essence of the phenomena, which must be considered when diesels are operated under low air and water temperature conditions.

Тем ра воздуха на входе в компрессор, °С / 1	Тем-ра заборн. воды на входе в холод., °С / 2	Степень охлаждения возд. в холодильнике / 3	Коэф. избытка воздуха при сгорании / 4	Тем-ра выхлопных газов перед турбиной, °К / 5	Период запазд. самовоспламенения топлива, сек / 6	Макс. давление сгорания, $\frac{кгс}{см^2}$ / 7
20	20	0,356	1,78	890	0,00119	107,0
0	0	0,356	1,99	814	0,001375	115,5
»	»	0,178	1,90	854	0,00117	112,0
»	»	0	1,80	898	0,00104	109,6
—20	»	0,282	2,18	756	0,00151	124,5
»	»	0,141	2,08	789	0,00133	121,3
»	»	0	1,59	8[illegible]	0,00119	119

Key: 1, air temperature at input to compressor, °C; 2, water temperature at input to cooling system, °C; 3, cooling of air in cooler; 4, excess air factor during combustion; 5, temperature of exhaust gases before turbine, °K; 6, delay period of ignition of fuel, sec; 7, maximum combustion pressure, kg/cm^2.

Recently, considerable attention has been given to limitation of loads during operation of forced diesels under low air and water temperature conditions. One important measure is reduction of the maximum power of the diesel which may exceed the specification power if the condition of the hull of the ship and the screws deteriorates or if wave action increases.

Of the possible means of limitation of mechanical loads and maximum power, we can note three: special design measures, limitation of the maximum fuel feed and adjustment of the cooling of injected air in the pre-cooler.

The most expedient design measure is bypassing a portion of the injected air at the input to the compressor.

Decreasing the fuel feed is the simplest and easiest means of limiting the maximum power and holding the maximum combustion pressure within permissible limits. However, the pressure rise rate may still be just as high in this case.

The goals outlined above can be achieved by adjusting the degree of cooling of injected air (decreasing the water feed rate to the pre-cooler, or shutting off water feed entirely). This can be seen by analyzing the results of calculations of the change in basic parameters of a type M503 diesel and maximum speed with the fuel lever wide open, depending on the air and water temperatures at the input and the adjusted degree of cooling of air in the pre-cooler (barometric pressure 760 mm hg, relative humidity 70%, fuel temperature 20°C).

As we can see from the calculations (see Table) when the air and water temperatures at the input drop to zero with unchanged degree of cooling of the air, a significant increase is observed in the air excess factor, which is equivalent (with unchanged fuel feed) to increasing the delivery of the compressor and maximum power of the diesel. This causes overloads on the supercharging apparatus and torque transmitting mechanisms. The delay period of ignition increases by 11.5% and the pressure rise rate in the cylinders also increases. The maximum combustion pressure increases by 8% and exceeds the permissible value of 110 kg/cm^2. If cooling of injected air is completely eliminated (degree of cooling zero), the parameters of the diesel do not go beyond the limits of their values under normal conditions.

As the air temperature at the input drops to -20°C and the cooling water temperature drops to 0°C, even with the cooling completely shutoff, the maximum combustion pressure is 8% above the permissible level. Therefore, in this condition, complete solution of the problem requires that the fuel feed be reduced as well.

The air pre-cooler of the type M503 diesel achieves a relatively low degree of air cooling (0.356). Many modern diesels carry pre-coolers with higher values of degree of air cooling (0.7-0.8). Obviously, for these diesels the influence of low air and water temperatures can be compensated to a greater extent.

The cooling of injected air must be adjusted not only when marine diesels operate in forced modes, but in other modes as well, all the way down to the lowest. The problem is that the increase in the spontaneous ignition delay period and the decrease in indicator efficiency at medium and low operating modes reduce the efficiency of the diesel under these conditions.

This analysis indicates the following main conclusions. The operation of marine diesels at low air and water temperatures causes an increase in the maximum combustion pressure and pressure rise rate in the cylinder as the crankshaft rotates. These increases are particularly great at near-maximum operating modes, reducing the reserve of the diesels. The operating process is also significantly worse under these conditions at reduced operating modes. The diesels become difficult to start, particularly with high supercharging.

Of the possible means of limiting the influence of low air and water temperatures on the operation of marine diesels, the simplest and most effective is adjustment of the cooling water feed to the air pre-cooler, or complete shutoff of cooling water feed, and if this measure if insufficient -- limitation of the fuel feed.

When the condition of the whole surface of the ship and of the screws deteriorates, or if wave action increases, which cannot be avoided at times, a marine diesel with the fuel lever fully open may produce power higher than its specification power. This causes overloads of the parts of the diesel and the parts transmitting torque to the screws. Therefore, the condition

of the surface of the hull and of the screws must be continually checked. Diesels must not be allowed to operate under these conditions with the fuel lever fully open.

It should be kept in mind that lower temperatures of exhaust gases observed at low air and water temperatures cannot be used as an indicator of the load on the diesel. When cruising in northern latitudes, ships personnel must check diesel parameters particularly carefully.

OPERATIONAL CARDS: HOW TO PREPARE THEM

Engineer Lt. Col. B. Farberman pp 24-26

Most engineering machines are based on track-mounted tractors, tanks or trucks. Therefore, in conserving them for long term storage, the technological processes involved in preparation of the basic chassis and operating equipment must be combined. These processes are generally described in different manuals, and the technical Deputy Commander must make up a single operational card for the preparation of the entire vehicle. Proper solution of this problem requires that the sequence of all operations involved in conservation of the machines and there interrelationship be clearly understood. In order to show how important this is, let us study the peculiarities of operations involved in so-called internal conservation.

These operations, as we know, include operations involved in the protection from corrosion of parts, instruments and units located within the body or unit. Internal conservation frequently requires partial dissembly and subsequent assembly of individual units on the machine. For example, preparation of the BAT road building machine for long term storage requires that unpainted parts of the electro pneumatic valves be covered with a protective layer of conservation grease. This requires that the electrical and air lines be removed, the valves be removed from the receiver, then dissembled, and after the proper conservation they must be re-assembled and returned to their position. The entire dissembly and assembly sequence for each electro pneumatic valve includes 18 technological operations. Sixteen operations are performed in dissembly, assembly and replacement of one pneumatic chamber.

Similarly, rather complex dissembly and assembly operations are required in preparation of most other engineering machines for storage. After performance of certain operations, the unit frequently cannot be operation tested, since this is equivalent to deconserving it. For example, in the E-305V excavator, after the conservation oil is poured into the cylinders of

the D-48L-S motor it is impossible to test the tightness of seal of the joints on fuel lines and sprayers. This would require rotating the crankshaft, which cannot be done, since fuel would be sprayed into the cylinders.

The requirement for this type of operation, including dissembly and assembly without subsequent functional testing of units, which is one of the characteristics of internal conservation as a technological process. Errors made during this process, for example improper adjustment and assembly of a unit, breaking of a seal in a fuel or air line, may cause defects leading to failures. These defects generally appear only when the machine is put back in operation. These defects are called technological conservation defects, since they are directly related to the process of preparation of the machines for storage. For example, mistakes made in preparation of the electro pneumatic valve of the BAT road laying machine may cause leakage of air through the joints between the air lines and the valve or between the valve and receiver, may break the contact in the electric plug.

Naturally, when conservation defects appear, additional time must be spent in preparing machines taken out of storage for operation. This explains the importance of preventing these defects. This requires primarily excellent training of personnel performing conservation, precise organization and strict checking of the quality of each operation performed. The applicable documents require that before machines are put in storage, the personnel in the Podrazdeleniye who will conserve the equipment must go through additional training. Explanation of the importance of the work being performed, detailed instructions with demonstration of important operations directly on the equipment, the use of specialized teams and the most qualified specialists for dissembly and assembly of complex units -- all of these measures help to serve the equipment better.

TABLE 1

Mechanisms and Systems of Operating Equipment	Operations Performed
Power takeoff mechanism	Drain oil from reducer, wash with diesel fuel and fill with conservation oil
Hydraulic drive system	Degrease and lubricate unpainted surfaces and shaft sectors protruding from hydraulic cylinders. Wrap shafts in waterproof paper and tie with twine.
Electro pneumatic control	Perform external inspection and connect electric control circuits to operating units of crane and power takeoff reducer, repair insulation as required, replace wires as needed, check tightness of all terminals in control circuit. Degrease and cover with K-17 lubricant, dissemble pneumatic chambers, prepare diaphragm (clean and powder with talc), assemble chambers.
Working organ	Set machine on rests, place bucket on supports.

TABLE 2.

Index	Operations
A	Repair insulation and replace unuseable wire; check tightness of all terminals and clamps in control circuit, degrease and cover with K-17 lubricant
B	Operation test all electrical control circuits of working organ, crane and power takeoff reducer
C	Start and operate engine to test mechanisms and systems of road layer
D	Drive machine to parking location at place on support
E	Drain oil from power takeoff reducer and fill it with diesel fuel for washing
F	Wash power takeoff by operating for 2-3 minutes, drain diesel fuel and fill reducer to normal level with conservation oil
G	Place blade on supports
H	Dissemble pneumatic chambers and prepare them for storage
I	Conserve engine and its systems, remove batteries
J	Degrease and lubricate unpainted surfaces and sectors of shafts protruding from hydraulic cylinders, wrap shafts in waterproof paper and bind with twine

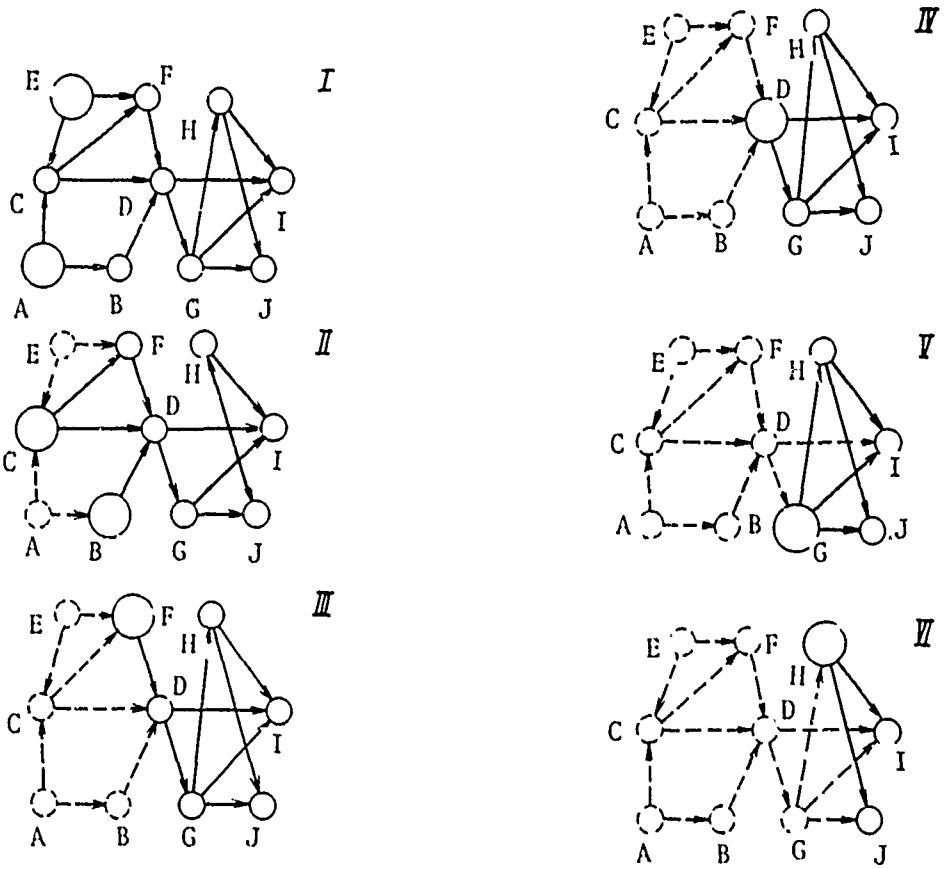


Figure 1. Graphic Diagram Showing Sequence of Technological Operations and Its Conversion by Method of Elimination (I-VI, sequence of conversions).

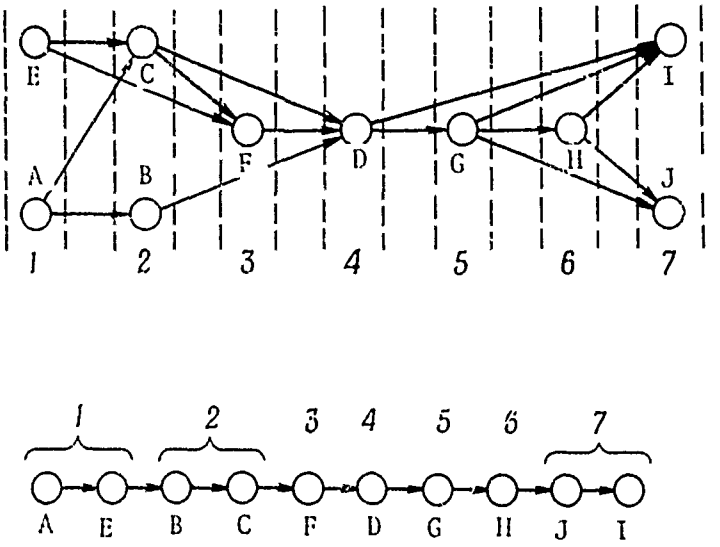


Figure 2. Diagram Divided Into Layers (top) and Resulting Sequence of Operations.

However, even if these conditions are followed, experience has shown, technological conservation defects may arise if the sequence of operations involved in servicing the machines is improper, if errors are made in composing the schedule of operations. For example, the sequence of operations involved in preparation of a machine for storage is incorrect if after conservation of the engine, certain devices and units are dissembled which cannot be operation tested after re-assembly without deconserving the engine. This occurs most frequently when the technology of conservation of the basic machine is not correlated with the technology of conservation of its equipment and attachments. For example, the electro pneumatic valve of the road layer can be checked only with nominal air pressure in the air brake system and with the electric system turned on. When the air valve is removed, the air in the brake system leaks out. If the engine is first conserved, then the operating equipment is to be prepared for storage, the operation of the valves and pneumatic chamber cannot be tested. Testing of conserved pneumatic chambers or electro pneumatic valves is generally possible, but in this case is simply impossible: conservation of the engine and compressor make this impossible.

We can see why in most cases when engineering machines are being conserved, it is impossible to perform all operations on the chassis first, followed by operations on the working equipment. In contrast, preparation

of mechanisms and systems of the working equipment for storage must frequently be performed before conservation of the basic machine. However, many technical documents first give the list of operations to be performed in preparing the machine for brief storage, then list the additional volume of work to be performed in preparing them for long term storage. No indication is given of the sequence for performance of the additional operations in relationship to the basic operations. If the additional work is performed after the work involved in preparation for short term storage has been performed, the sequence of operations will be inefficient and instances similar to those described above may occur.

Thus, well thought out operation cards are important for the assurance of high quality of work in the preparation of machines for storage. How can such a card be properly composed if technological processes of conservation of the basic machine and additional equipment must be combined? Let us use an example to study this.

Suppose we must prepare a type BAT-M road layer for storage. Before composing a card, let us analyze which operations must be performed on the working equipment of the machine and note which of these operations must be correlated with other operations. A brief list of such operations is presented in Table 1.

In order to determine the sequence for performance of the operations listed in the Table, we must reveal the interrelationship between them. To do this, let us analyze the content of each operation.

Obviously, preparation of the power takeoff mechanism for storage requires that the engine be started and the power takeoff mechanism be engaged, and this must be done twice: the first time in order to wash the parts of the reducer (after the oil has been drained and diesel fuel poured in), the second time, in order to distribute the oil film over these parts. The shafts of hydraulic cylinders should be serviced only after the machine is set in its storage location and its working organ is on the supports, i.e., after all operations involving use of the hydraulic drive system are completed. Preparation of the electro pneumatic control equipment should be completed before beginning conservation of the engine and compressor. Work on the pneumatic chamber should be completed so that it need not be used again after conservation is completed.

Considering the interrelationship of the operations allows the proper sequence of work involving conservation of this machine to be determined. When the number of operations and the relationships between them are not great, it is easy to determine their interrelationships. By using operational cards for conservation of the basic chassis and the operating equipment, we can compose an overall operations card for preparation of the machine for storage. It is considerably more difficult to perform this task if we must correlate large numbers of interrelated operations. In this case, it is most convenient to use one of the methods used for the composition of network graphs.

In the technological process of conservation of the basic machine, we distinguish those operations with which operations involved in preparation of the working equipment to storage are related. Supplementing the list of basic operations made earlier, we produce a detailed description of the work. Table 2 shows a portion of the operations on the basic machine. Each operation is represented by a number or letter. The order of numbering is arbitrary, since the sequence of performance of the operations is determined later, based on analysis of the technological processes of conversation of the basic chassis and operating equipment.

For our analysis we construct a graphic net (Figure 1). The circles (points on the net) represent operations, while the arrows indicate the relationships between these operations, reflecting the sequence of their performance. Those points from which arrows are drawn represent the primary (preceding) operations. We note that in contrast to network graphs, the time expended on the performance of each operation has no significance in this graph.

In order to determine the optimal sequence of operations, i.e., put the process in order, we divide the graph into so-called layers. We find the points representing "independent" operations. In our example there are two such points: A and E. They form the first layer. Crossing them off of the graph, we look for similar points in the remaining portion of the net. After finding that these are points C and D (second layer), we cross them off as well. This operation is repeated until the entire net is divided into layers. It is now easy to restructure it so that all points in each layer representing the primary operations are on the left.

Figure 2 shows a net constructed in layers as applicable to our example. Obviously, the operations card for preparation of the BAT-M machine for long term storage shows operations in the second layer (B and C) which must follow the operations in the first layer (A and E), i.e., servicing of the electric circuits and power takeoff reducer should be performed first. It makes no difference in which sequence the operations within a layer are performed (they can be performed simultaneously). The sequence of performance of operations in all subsequent layers is equally insignificant. As a result, we produce a sequence of performance of all interrelated operations (see Figure 2). Now in our description we must consider the operations, the performance of which does not involve any danger of appearance of technological defects, as well as operations which can be performed at any time (for example decreasing degreasing of the front portion of the blade and painting of the blade).

As we see, this method of composition of operations cards is not difficult. Its use, in our opinion, will make it significantly easier for officers to organize preparation of equipment for storage.

THE PREDECESSORS OF THE TYPHOON

p 26

Mr. De Lamber, a citizen of Russia, patented a hydrofoil craft in France in 1891, in the USA in 1894. Since that time, many designers have planned and constructed vessels of this type. However, the new principle was not widely used for sometime.

Since the War, active work has been developed in many countries of the world on hydrofoil craft. Significant successes in this area have been achieved in our country as well.

An experimental craft designed by State Prize and Lenin Prize Laureate Doctor of Technical Sciences R. Ye. Alekseyev, constructed at "Krasnoye Sormovo" Plant, developed a speed of approximately 130 km/hr in 1956. Two years later, the Volga designers tested the passenger vessel Raketa, well-known in many countries of the world. The engine of the Raketa is a high speed 900 hp diesel. It pushes the ship with 66 passengers at over 60 km/hr.

Since that time, many types of hydrofoil vessels have been designed in our country. These include the steamships Meteor, Sputnik and Chayka, as well as Kometa, Vikhr' and other ships, the speed of which reaches 60-100 km/hr. During the Ninth Five-Year Plan, the construction of powerful, high-speed typhoon-class vessels with automatically controlled hydrofoils will be widely developed.

STORAGE OF AMMUNITIONS

Engineer Major S. Pechenov pp 26-27

One necessary condition for reliable protection of ammunition from corrosion during long term storage is maintenance of the proper temperature and humidity of the air in the storage area. Observations have shown that daily temperature changes in most areas of the country frequently exceed 10°C, and in regions with hot, dry climate these changes reach 20°C or more. These sharp changes may cause breakage of internal seals, as well as the appearance of moisture.

Experience has shown that the influence of temperature and humidity on the condition of ammunition depends to a great extent on the design features of the storage areas and on their ventilation and the placement of the ammunition. Depending on the material of the walls, roof and floors, and on whether a roof covering is used, ammunition is cooled or heated to a varying extent. For example, a roof covering, decreasing the influence of high temperatures, reduces heating of storage areas in the spring.

Let us study two typical cases of storage of ammunition in unheated storage areas: in large piles, in unsealed packages (generally wooden) and sealed in small groups or individually.

In the first case, a large mass of ammunition, stacked tightly in piles and the low heat conductivity of the wooden boxes containing the ammunition, preventing heat exchange with the surrounding air, facilitates the creation of an independent microclimate in the storage area, distinguished by relatively constant temperature. In order to heat a pile (consisting of 1,000 100 mm shells) by 1°C, 12,500 kcal of energy must be expended. Therefore, even sharp daily fluctuations in temperature of the surrounding air do not cause any significant change in temperature of the ammunition (Figure 1).

Consequently, relatively favorable conditions are created for protection of the internal parts of the ammunition from corrosion. However, condensates may appear on the outer surfaces of the ammunition. This results from the

fact that during winter the temperature of the ammunition drops, although slowly, to -10°C and lower (Figure 2), and in the spring the warm outer air with its high absolute moisture content enters the storage area and penetrates to the ammunition through the unsealed packing. Therefore, if the ground beneath the storage area is frozen to a significant depth and thaws slowly, the film of condensate may remain on the outer surfaces of the ammunition for a long time.

Observations have shown that in the spring and summer in storage areas full of ammunition the air has high relative humidity. This is why in the spring and early summer, particularly with this method of placement of ammunition, the temperature of the ammunition must be equalized with the outside air temperature as quickly as possible. Achievement of this equalization depends primarily on efficient placement of piles, providing maximum air exchange. It is best to place them on the tallest open pallets (optimal cross section 18 × 24 cm) and to make air passages 30-40 cm wide each six to eight meters in large piles. At least 50 to 60 cm of free space should be left between the top of the pile and the ceiling between the sides of the piles and the walls.

Timely removal of snow from the roof and walls, cleaning and preparation of the canals and pipes allowing the runoff to be removed, and systematic ventilation of rooms are also important for warming of storage areas. Ventilation can be used to both warm the storage area and decrease the absolute moisture content of the air within it. During ventilation, the condition of the outside air must be constantly checked and the dew point determined periodically. If the dew point is equal to the temperature in the storage area or above it, ventilation should be interrupted in order to avoid the appearance of dew or frost. If condensation occurs, all measures should be taken to dry the storage areas, using any favorable time, including the evening and night hours.

The dew point of the outside air is generally found using special tables. To do this, the relative humidity and temperature are used to determine the absolute moisture content, then it is looked up in another table to determine the dew point. It can be established with good accuracy using a nomograph (Figure 3). Let us explain how this is done using examples.

Suppose the relative humidity of the outside air is 62%, the temperature is 25°C, the temperature in the storage area is 15°C. Can ventilation be performed under these conditions? Let us look at the nomogram. From the point corresponding to a relative humidity of 62%, we drop a perpendicular until it intersects the sloping line of temperatures representing 25°C. From this point, we draw a horizontal line until it intersects the curve, then once more drop a perpendicular until it intersects the base of the nomogram and determine the dew point. It is 17°C. In this case, ventilation should not be performed, since the outside air entering the storage will be cooled to 17°C, and dew will begin to form

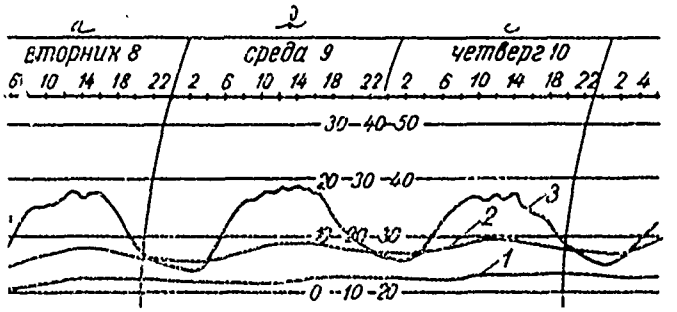


Figure 1. Daily Changes in Air Temperature Recorded on Weekly Thermogram Charts: 1, in storage area 100% full; 2, in storage area 50% full; 3, outside storage area.
a, Tuesday 8; b, Wednesday 9; c, Thursday 10.

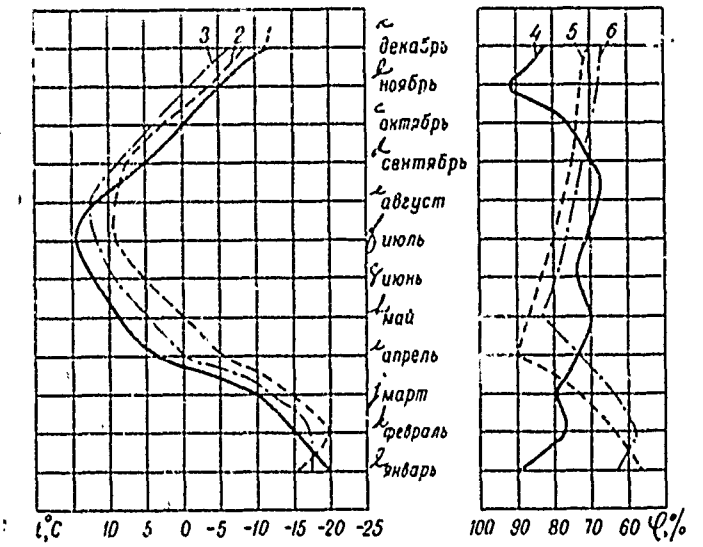


Figure 2. Mean Monthly Values of Temperature (t°C) and Relative Humidity (ϕ, %) in Unheated Storage Areas with Various Degrees of Filling with Ammunition (moderately cold climate): 1, 4, outside air; 2, 5, in storage area, 100% full; 3, 6, in storage, 50% full.
a, December; b, November; c, October; d, September; e, August; f, July; g, June; h, May; i, April; j, March; k, February; l, January.

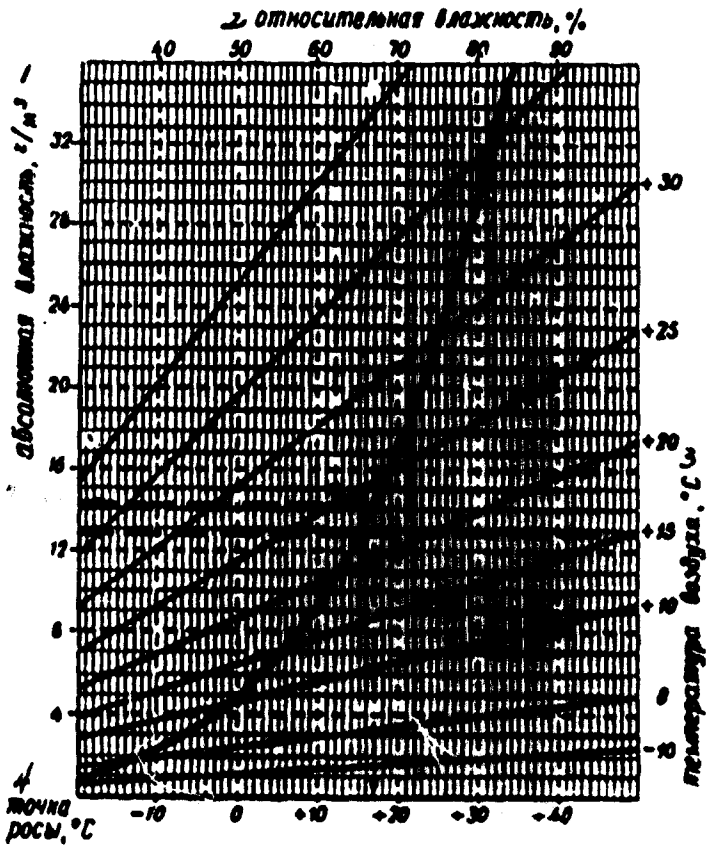


Figure 3. Nomogram for Determination of Temperature and Humidity Regime.
1, absolute moisture content, g/m^3; 2, relative humidity, %; 3, air temperature, °C; 4, dew point, °C.

Using the nomogram, we can determine how much moisture will be converted to the liquid state from the vapor state. Using the noon temperature and relative humidity, we determine the absolute moisture content of the outside air. It is 14 g/m^3. At the temperature in the storage area, 15°C, the air can contain a maximum of about 13 g/m^3 water vapor. Therefore, each cubic meter of air entering the storage area will lose approximately 1 gram of water. A number of other problems can be solved using the nomogram. For example, we can determine how much the temperature in the storage area must be raised to reduce the relative humidity by some required percent.

To determine the air temperature in the storage area, we use mercury or alcohol thermometers, while continuous changes in temperature are recorded using weekly (M-16N) or daily (M-16S) thermographs. The relative humidity is measured with a hair hydrometer or meteorological hygrograph (M-21). When we must know its value more precisely or check the indications of the weather devices, we use psychrometers and special psychrometric tables.

When devices are not available for determination of the expediency of ventilation, bottles filled with water (or if the temperature in the storage area is below freezing -- filled with 15% salt solution). They are usually placed in the coldest areas. Before ventilation, they are carried out of the storage area and set in the shade. If they are covered with dew in two or three minutes, ventilation should not be performed.

As concerns conditions of storage of sealed ammunition not in piles, their mass is not great and their heat capacity is low. Consequently, the microclimate in the storage area will be the same as the outside climate and the ammunition is subjected to sharp changes in temperature. The most unfavorable conditions arise within sealed volumes in this case -- the probability of periodic condensation arises. It is impossible to eliminate completely the effects of sharp temperature fluctuations and appearance of moisture in the sealed volume, but the effects can be reduced. First of all, each sealed volume should contain special moisture absorbers. During storage, condition of these absorbers must be frequently checked and they must be replaced when fully saturated with water.

Long conservation of the internal elements of ammunition depends on the quality of conservation and observation of the temperature and humidity regime in the room where the ammunition is sealed. For example, if the ammunition is sealed at 20°C with a relative humidity of 60%, the dew point will be reached when the temperature drops by 10°C. It is important to consider the initial moisture content of materials placed in the sealed volume. This must be done, since due to fluctuations in temperature, even slight quantities of moisture evaporating from plastic parts, leather, organic coatings and other materials, may condense on important metal parts, causing corrosion.

If such corrosion substances as sulfur and sulfur compounds, per chlorates and ammonia are present, and these are components of many powders and pyrotechnical compositions, the corrosion rate may increase significantly. This in turn may cause serious changes on ammunition parts.

Timely and correct consideration of the influence of weather factors on the storage conditions of artillery ammunition will allow long term storage in both cases.

CONSERVATION OF OPTICAL DEVICES

Lt. Col. V. Zhigalov

pp 28-29

Modern optical devices are distinguished by precision adjustment and high reliability. However, like all other products with optical parts, these devices are sensitive to various types of shocks and vibration, and therefore must be treated with care. The rules for operation and storage are basically outlined in the corresponding guides and instructions. We will discuss here the possible results of failure to follow these rules and how to detect and eliminate the defects which arise.

One reason for damage to these devices is failure to be careful with them during use. For example, unless these devices are fastened in the proper places during transportation, the adjustment of the optical system may be damaged due to the shocks, jolts and vibrations, and the parts of the optical system may shift relative to each other. This results in such defects as parallax (impossibility of producing a sharp image of the grid and target simultaneously) tilting of the grid or of the image. In binoculars, the optical axes may be no longer parallel, producing double images (Figure 1, a), causing the observer to fatigue rapidly and make errors in measurements.

Improper servicing may also produce double images.

For example, in binoculars this type of image appears if the lens clamp is moved due to excessive force applied in checking its position.

Parallax results from movement of the grids or marks along the optical axis. It is not difficult to detect parallax in devices with rotating ocular lenses. One need only adjust the grid and image to sharpen the focus in sequence. The difference of the readings on the diopter scale indicates the degree of parallax (0.5-1.0 diopters or 1-2 angular minutes, is considered permissible for most devices).

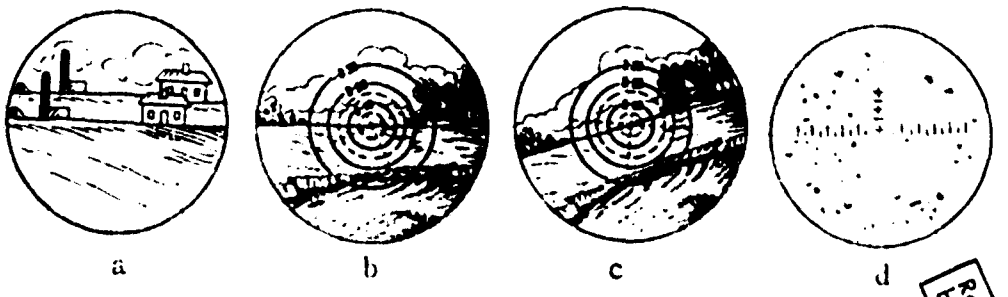


Figure 1. Defects Resulting from Mechanical Actions: a, double image; b, lateral displacement of the grid; c, tilting of the image; d, dusting.

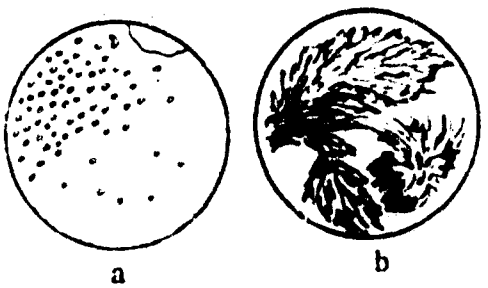


Figure 2. Defects Resulting from Climatic Factors: a, hygroscopic; b, biological deposits.

Lateral displacement or tilting of grids (Figure 1, b) and marks makes it difficult to sight the device on the target. It is particularly difficult to perform precise tracking of a moving target, to determine the range to the target, for example when operating with stereoscopic range finders, with this defect. Lateral displacement may also occur when the tightness of mounting of oculars is checked, if the base of the ocular is moved due to excessive force. Movement of prisms, lenses and reflectors may cause the image to tilt (Figure 1, c), making observation and determination of target coordinates difficult. These defects in the optical system cannot be repaired in the Podrazdeleniye. Devices with these defects should be sent in for repair.

If used improperly, parts of optical systems may break, crack or come unglued, but most frequently, so-called dusting occurs. Particles of varnish, anticorrosion coatings or lubrication fall onto the surfaces of glasses due to vibration (Figure 1, d). If the optical part is not in the focal plane, solid particles striking it are observed in true size. This has practically no effect on the combat usefulness of the device. If dusting occurs on grids or surfaces near the grids, the problem is more serious. Then dark points or groups of points appear in the field of vision. Dusting with large particles makes it difficult to use devices. If particles fall on the cross hairs of the grid, aiming accuracy is impossible. Devices for these defects must generally be prepared.

Dusting, however, is not always a reason to send the device into the shop. The instructions for categorization state that devices are considered useable if dusting on grids, marks and other optical parts does not distract the attention of the observer or if it is difficult to see from the ocular and in the direct light. Defects of internal optical parts visible from the objective lens end but not serious enough to interfere with observation are also not a reason to send devices in for repair.

So-called deposits appearing at times on the surfaces of glasses resulting from failure to observe the rules for storage or untimely servicing are dangerous in that they may damage the polished surfaces of the glass and reduce the quality of the image. Hygroscopic, biological and grease deposits are particularly frequent (Figure 2).

A hygroscopic deposit means formation of large quantities of small drops of water on the surfaces of optical parts. These droplets grow, become visible and hinder observation. The moisture causes the glass to be leached and damaged. Its surface is covered with a network of fine cracks. This type of deposit may result from sharp temperature changes in the surrounding air, operation of devices under high humidity conditions or with defective drying packets, breaking of seals or damage to the lubrication with which certain parts are covered.

Practice has shown that timely and proper care, even in regions where precipitation is extensive and the relative humidity is much higher than the average, can protect optical devices from deposits. First of all, the condition of leather and wooden cases, canvas covers and packing boxes should be checked. We know that devices stored in dry cases and packing boxes are much less subject to the influence of moist air. It is equally important to protect the devices from moisture, particularly when operating in rain, and to dry wet devices properly: summer in air in the shade, winter in a room at some distance (at least 1 m) from central heating batteries, stoves and other heating installations. The appearance of deposits is impossible if devices are carefully inspected after use and the condition of places where waterproof seals are installed are checked and dust and moisture are removed from the surfaces of devices.

The surfaces of parts, including internal parts, will become wet when used in winter, for example when a device is brought into a warm room and

removed from its case. This should be avoided. The device should be left for some time in an area where the temperature is low (in a vestibule). Then, when the device is brought on into the warm room, it should not be removed from its case for 1 or 2 hours, until it warms up to the temperature of the surrounding air. After being removed from its case, the device is then carefully dried.

Devices carried out into the cold should be left in their cases for 15 to 30 minutes. Otherwise, the moisture will precipitate from the air in the internal cavities of the devices and settle on the parts.

Many devices are equipped with drying packets. They operate quite reliably until the adsorbing composition with which they are filled is completely saturated with moisture. It is easy to determine the moment of saturation from the color of the absorber, which changes from bright blue to pale pink or dirty white, depending on the substance used.

The usability of an absorbent can be restored by heating the silicon gel or alumino gel at 150-250°C, or indicator silica gel at not over 120°C, since otherwise its properties will be partially lost. The temperature can be determined without a special thermometer -- by a drop of water. When a sheet of metal (or pan) is heated to less than 200°C, the drop of water will spread and boil, while at 200-300°C it will "run" over the surface in a ball and gradually evaporate, and at over 300°C it will "explode."

Usually, when a spare packet is placed in the device, the moisture disappears rapidly from the optical parts. If this does not occur, devices having drying valves are blown through with dry air using special blowers. This type of preventative operation should also be performed during maintenance No 2.

Biological deposits are formed for other reasons as well. One might be entry of tiny crumbs of bread, tobacco or paper into the device during repair or use, accompanied by mold spores. Biological deposits destroy the coatings on the lenses and make observation difficult.

Grease deposits on the internal surfaces result from entry of lubrication into the optical parts, which occurs only if the rules of usuage are not followed: the device is either exposed to the sun for long periods of time, or subject to vibration or shock. The deposit consists of a film or tiny droplets of grease. It is similar in appearance to a hygroscopic deposit. Therefore, in determining defects one must be quite careful. This deposit may also appear on the outer surfaces of lenses if they are touched by the hands.

Grease and biological deposits are removed from the outer surfaces of optical parts with a clean rag or flannel. In case of severe deposits, cotton is wet with alcohol or petroleum ether. The excess liquid is lightly squeezed from the cotton and the glass is rubber several times, without touching the mount. It is very important that this solvent not get beneath the mount, since this may break the seal of the device or cause the lens to

come unglued. The glass is then finally dried with a dry cotton.

Thus, proper operation and timely repair of optical devices are necessary condition for constant combat readiness of the devices.

REMOVAL OF EQUIPMENT FROM STORAGE

Lt. Col. M. Shnir p 29

Removal of special equipment from long term storage depends to a great extent on the ability and practical skill of the personnel. In order to perform this work with good quality, standard recommendations must be available, so that the specialists can perform all operations involved in deconservation of the special equipment with the minimum expenditures of times and expendable materials and in the proper sequence. In our opinion, this is greatly facilitated by the use of technological deconservation cards, developed for each type of equipment. These cards show the sequence of work to be performed. The first order of work consists of removal of covers or tarpaulins from the equipment, removal of canvas covers from tanks, replacement of rubber-fabric and rubber-metal hoses or winding of these hoses onto their drums. These operations are performed where the machines are stored in a few minutes.

The second order of work must be performed by specialists (two men per machine) outside the motor pool -- in parking areas, and areas of concentration. For example, the seals of the side boxes are broken on the ARS-12U motorized distribution stations, the equipment is removed from the boxes, hoses are removed from the tanks. Then a cloth wet with kerosene is used to remove the grease layer from the hose fittings and the surfaces of the equipment. The surfaces are then wiped dry with a clean cloth. These operations also require a few minutes. After preparing the removable equipment for use, the specialists deconserve the nonremovable equipment. Oil is removed from the internal surfaces of the tanks, the throat covers and anti-explosion screens. The oil is poured from the mechanical and manual pumps, the equipment is returned to its place and fastened down. The side boxes are closed, the tank is covered with canvas.

It must be considered that the time required to bring the equipment into combat readiness depends to a significant extent on the temperature -- it is increased as the temperature drops.

In preparing DKV machines for use, the fastening of the rear end wall of the cover over the machine and trailer are released, after which the boxes containing the PET are removed from the bed of the vehicle and trailer. A cloth with kerosene is then used to remove the grease from the equipment and tools and they are dried with a clean cloth. The ciphon filters and plugs are treated in the same manner, as well as the air nipples and safety valves.

It is much more difficult to prepare the special equipment of the AGV-3M motorized degassing station for use. In order to simplify this process somewhat, we have developed a technological card for each type of machine (power, degassing and auxiliary). They note the sequence for performance of operations to help bring the equipment into working condition more rapidly. For example, in deconserving the power machine we first remove the lubricant from the unpainted equipment of the boiler, steam collector, chains and sprockets of the ShVN-1 and MSh-3A pump drive systems, then use a cloth wet in gasoline to remove the lubricant from the "Moskvich" motor, after which we remove the seals from the generator, air cleaner, starter and the joint between the distributor cover and body.

After performing these primary operations, the engine is prepared for use. This is done by draining the conservation oil from the crankcase and filling it with standard oil, filling the cooling system with water or antifreeze. The float bowl of the carburetor is filled with gasoline by pumping it in manually with the fuel pump, the motor is started and its operation tested at various speeds.

When the degassing machine is prepared, the lubricant is first removed from the parts of the ammonia generator, hot air exhaust hatches, feed lines and condensate drain lines. All parts and units in the water trap, injectors, control devices, plugs and condensate drain valve in the rear cabin are carefully wiped with a cloth wet with kerosene.

The equipment of the auxiliary vehicle (steam lines, hoses and tools) is degreased after it is unloaded. The oil is then drained from the hand pump and it is washed several times to remove the traces of oil. The pump is then placed on its support.

The technological parts help us to perform all these operations involved in preparing the special equipment on the vehicles of the chemic protection Podrazdeleniye for action and prepare the necessary materials and tools for this purpose in the proper sequence.

The technological cards for deconservation of special equipment, our experience has shown, are particularly needed by those people who have not accumulated sufficient practical experience.

MAGNETIC POWDER TESTING OF PARTS

V. Ignat'yev and A. Aleksandrov p 30

We know that magnetic powder testing with residual magnetization in the longitudinal direction is used to detect cracks in steel parts. However, this method does not indicate even relatively serious defects if the magnetizing field is strong between the poles of the electromagnet. For example, checking of parts made of magnetically hard steel such as bolts, lugs, aircraft chassis shock absorber supports always leads to unsatisfactory results -- the small cracks are not found even if the magnetic field intensity between the poles of the magnet reaches 300, 400 or even 500 oe.

The capabilities for the use of the electromagnet for testing of various parts can be expanded. This requires that the field between the poles be changed rapidly. Cracks will then be clearly seen.

However, regardless of the rate at which the current is switched off, the magnetizing field between the poles of existing electromagnets drops slowly. This results from the high induction of the winding of the electromagnet and the great magnetic viscosity of its magnetic circuit.

With a stationary electromagnet, the magnetic field is changed suddenly by breaking the magnetic circuit at both poles, i.e., by removing inserts made of magnetically soft material, and simultaneously cutting off the current in the windings. A diagram of the device realizing this method is presented on Figure 1. Part being testing 1 is placed between the poles of electromagnet 6 for magnetization. Breaker 3 closes the electric power circuit of the electromagnet and, removing inserts 2 and 5 by means of mechanism 4, the electric and magnetic circuit are broken simultaneously.

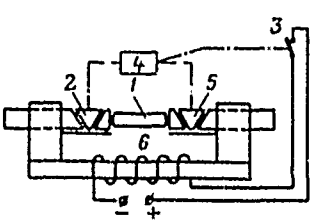


Figure 1. Diagram of Installation Allowing Rapid Elimination of Magnetic Field.

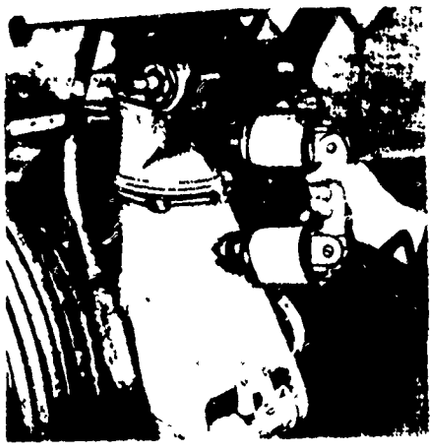


Figure 2. Magnetization of Sector of Aircraft Chassis Upright with the Device.

The magnetic field of the manual electromagnet is suddenly decreased in a different manner. The electromagnet, installed on the part, is suddenly moved from its surface and the current in it is not disconnected. This method of increasing the effectiveness of magnetic testing can be easily used, for example in testing aircraft chassis uprights (Figure 2), main wing beams and other massive parts and units.

AIRCRAFT-BORNE RADAR

In 1940, specialists at the Red Army Air Force Scientific Research Institute suggested that a "Redut" radar be installed on board an aircraft, in order to solve the problem of detecting the enemy in the air and guiding fire under conditions of poor visibility.

Since, according to preliminary calculations, the airborne version of the radar should weigh about 500 kg, it was decided to place it on a Pe-2 two-place bomber.

In early 1941, the laboratory model of the "Gneys-1" radar was created, the transmitter of which was powered by klystrons and operated in the pulse mode. In June of 1942, an improved version, the "Gneys-2" was plant tested. One month later, state tests were held. Based on the results of these tests, the first aircraft radar, the "Gneys-2," was accepted by a resolution of the State Defense Committee for the Air Force and put in series production.

AIR LINE

The first air line in the USSR was opened in June of 1923 between Moscow and Nizhniy Novgorod (now Gor'kiy). The line was 420 km long. By the end of the year, 229 passengers and 1,900 kg of mail had been carried over this line. This year, Aeroflot plans to carry 87 million passengers and over 2 million tons of mail and cargo.

UNDAMPING OSCILLATION GENERATOR

The first undamping oscillation generator was constructed in Russia in 1911. The generator was an electric arc and a high frequency machine developed by V. P. Vologdin. Since 1920, vacuum tube generators are most commonly used, opening new prospects in the area of generation of waves over a broad frequency range.

UNDER HOT CLIMATE CONDITIONS

K. Shpilev, Candidate of Technical Sciences and A. Kruglov,
Candidate of Technical Sciences pp 30-31

The high dust content of the air in regions with hot climate, significant fluctuations in air temperature through the course of the day and intensive solar radiation make operation of aviation equipment more difficult. The abrasive effect of the dust and sand breakdown paint and varnish coatings, tiny cracks are formed on the glass of sealed cabins ("silver"), scratches appear, causing the optical properties of glass to deteriorate. After exposure to ultraviolet rays, cabin glass may yellow. In order to avoid these problems, aircraft and helicopters are generally stored in covered areas, their surfaces are carefully protected with tents.

High temperatures may cause oil to flow out of clearances. This causes rapid wear of friction surfaces. Under these conditions, oil must be replaced quickly, friction surfaces must be protected from dust by using covers, plugs, caps, protecting air intakes and drainage apertures. Military rationalizers can make simple devices in addition to the standard set of equipment for ground use to prevent dust from penetrating into the aircraft, equipment and air intakes.

Dirst is particularly harmful to friction surface in chassis, where scratches and deep gouges may form. The pins supporting shock absorbers and landing gear uprights, bolts and lugs, uprights, hydraulic cylinder pistons and landing gear lifting mechanisms are rapidly worn. Answering aircraft sections, dust causes corrosion of the surfaces of units. Dust is removed with vacuum cleaners or compressed air fed in through special fittings into difficultly accessible areas.

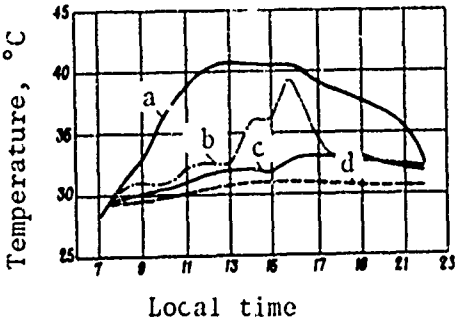


Figure 1. Change in Air Temperature Outside (a) and Inside Rooms with Windows Turned to the West (b), East (c) and North (d).

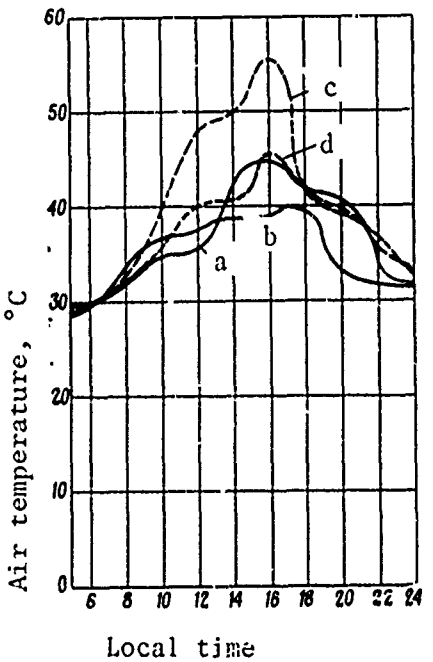


Figure 2. Daily Changes in Temperature of Surrounding Air (a), in Fuel Tanks (b), and in Cabin of Uncovered (c) and Covered (d) Aircraft.

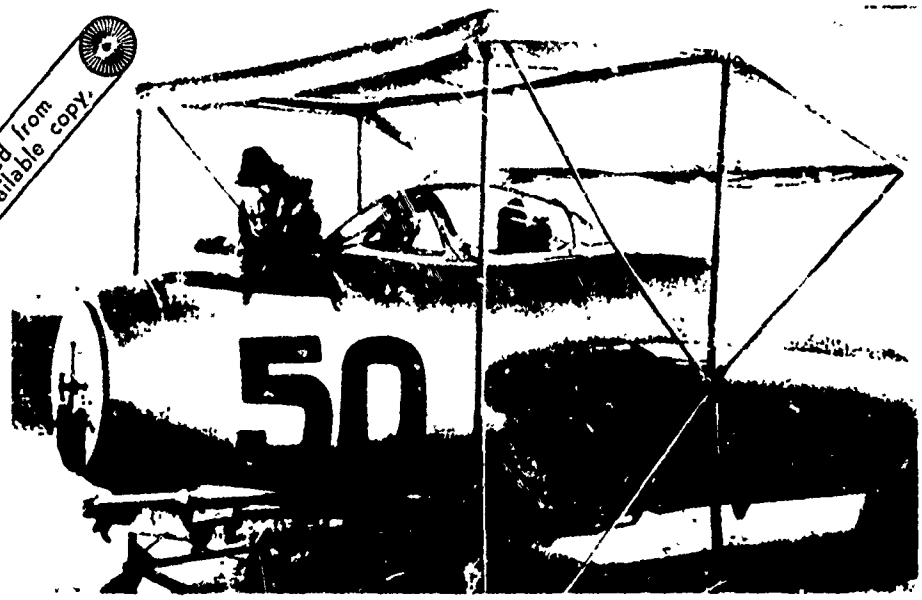


Figure 3. Tent for Protection of Aircraft Cabin from the Sun.

As hydraulic system tanks are filled, unless caution is exercised, dust may enter the fluid. This may cause scratching of valves and damage seals. It is therefore necessary to be sure filling equipment is clean, to check the condition of the working fluid periodically and change it when necessary, and to fill hydraulic systems carefully, observing all safety measures and using dust protection devices.

Heat tires the personnel and reduces their efficiency. All possible measures must be taken to reduce the temperature in working areas and aircraft cockpits (Figure 1). Proper selection of the type of buildings and their efficient orientation in relationship to the sun are significant in this.

The air temperature in the cockpit of an aircraft, as well as the fuel temperature in tanks, change sharply during the course of the day (Figure 2) and aircraft skin and airfield equipment may be heated to 70-80°C, then cool significantly at night. Such simple devices as shade tents (Figure 3), canopies and covers, by illuminating the direct influence of sunlight, decrease the temperature of the aircraft and its internal spaces.

Sometimes aircraft covers are wet with water, reducing the air temperature in the cabin to 2-6°C below the temperature of the surrounding air. However, this requires a great deal of water, which is in short supply in many areas with hot climate. For example, wetting of a nose cone of a fighter requires about 50 liters of water, which evaporates completely in 15 to 20 minutes. Also, wetting may cause corrosion damage of aircraft parts due to salts dissolved in the water.

The most effecti.. means of maintaining normal temperature conditions in aircraft cabins i.. the use of surface air conditioners, continually pumping cool air [illegible] cabins. For heavy and medium transport aircraft with surround[illegible] temperatures up to 45°C, air conditioners can deliver air cooled to [illegible] the cabins.

Poor cooling [illegible] may reduce the reliability of brakes, particularly when flights are short and frequent. Sometimes, brake drums are cooled with water when the wheels are overheated. However, it must be recalled that the wheel material [illegible] crack due to the sharp temperature drop.

If the ambient air temperature changes greatly, the parameters of operation of jet [illegible] must be checked carefully. The efficiency of the engines may drop because of clogging of choke packets, jets and filters in the fuel apparatus, and [illegible] in the combustion chamber, with solid particles. To increase the operating stability of engines, the fuel system must be carefully cleaned to remove dust.

The instrument and oxygen equipment must be particularly carefully checked. For example, oxygen hoses and hoses in the PVD system may crack due to the effects of dry air and high temperatures, while the membranes of safety valves and pressure regulators in sealed cabins may lose their elasticity and break.

The operation of electronic equipment is also complicated due to the high wear rate of antenna wires and other electromechanical devices and the necessity of removing dust from equipment.

Certain difficulties may arise in towing aircraft equipped with high pressure tires over dry sand when, for example, the tow truck may not have sufficient power. Various methods are used in this case to increase the supporting surface of the aircraft. For example, two-wheel bicycle-type trucks may be installed on each landing gear upright or a second wheel may be mounted on an additional axle on the main landing gear upright.

When the air temperature is high, the operating qualities of concrete-covered runways deteriorate. For example, the material filling the expansion seams on concrete runways melts. Metal runway covers are deformed, forming tracks, increasing the labor expenditure required to maintain the airfield in a condition suitable for use.

However, practice has shown that even under hot climate conditions, if initiative and organization are constantly demonstrated, the aviators can utilize their aviation equipment without accidents, performing the important tasks set before them.

ADJUSTMENT OF RADIO EXCITORS

Engineer Major A. Artemov and Engineer Yu. Bomshteyn pp 32-33

The master oscillators used in the radio transmitters of most radio stations of medium and high power such as the R-103M and R-118BM-3 are discrete frequency spectrum excitors such as the VT-23, VT-44 and VT-53. They use the same type of circuit and differ only in the frequency range and frequency shifts, greatly facilitating their adjustment. Adjustment can be performed under field conditions using proper measuring instruments: the AVO-5 volt-ammeter, a vacuum tube voltmeter and an oscilloscope.

Let us study the main stages in adjustment, using the names of the elements in the electrical circuit of a typical excitor.

Adjustment is generally begun by checking the thermostat heating system, which should maintain a temperature of +75°C. Indications of normal operation are the lighting of the "thermostat" signal lamp installed on the front panel and the proper current (50-70 μa) in tube V31 following ten minutes warmup.

To check the stability of the operating temperature, the thermal fuse is replaced by a clip and a thermometer with a scale reading to +100°C is inserted in the seat for the fuse. If the temperature differs from the nominal temperature by more than ±3°C, it is adjusted by potentiometer R2. When the temperature is above normal, the potentiometer lever is rotated so that the current of tube V31 decreases, when it is below normal, it is rotated so as to increase the current. After the temperature is set within the normal limits, the temperature fuse is returned to its place and the thermostat is closed. Its cover should be inserted on its guides, the aperture placed over the cap of the thermal fuse. Otherwise should a defect arise in the circuit, the thermal fuse will not operate and the thermostat or heating transformer might be damaged.

If when the excitor is turned on the "thermostat" lamp does not light, first check the fuses, then all power supply circuits from the input terminals to the primary winding of the heating transformer (wires 43 and 44). When the "thermostat" lamp does burn, but there is no current from tube V31, the most rapid method of determining the point of the defect is to replace the thermostat with one which clearly works.

Normal operation of the crystal oscillator is judged from the parameters of tube V1. To be sure of oscillation, pull out tube V3 and use the VTVM to measure the output voltage of the crystal oscillator at its seventh pin. It should be approximately 7 v. Oscillation may stop for such reasons as a defective crystal, a short in the circuit of the output signal and variable condensor, or defective tubes V1 or V2. The output voltage of the crystal oscillator is reduced if there is an open circuit in the anode circuit of tube V2 or excessive feedback, causing the first divider not to be excited. To decrease the depth of feedback around the master crystal oscillator stage, decrease the capacitance of variable capacitor C11.

To set the frequency of the oscillator at 1 MHz with an accuracy of ±1 Hz, as is called for by the operational documents, use the oscilloscope and a standard frequency source. Frequency standards, as we know are transmitted on a special schedule. If necessary, oscillations at 200 KHz provided by the R-154 receiver can be used as a frequency standard. This signal is fed to the Y input of the oscilloscope, the crystal oscillator signal is fed to the X input, after first switching off the horizontal scan. A five-peak curve should appear on the screen. If the frequency ratio 1,000 KHz: 200 KHz = 5:1 is precise, the figure on the screen will not move. If it rotates, variable condensor C1 should be adjusted until the figure stops.

To check the adjustment, touch the bear wire leaving the thermostat with a screwdriver, which is equivalent to increasing the capacitance. If the rotation of the figure on the screen slows, the capacitance of the tuning condensor must be increased. If the movement of the figure becomes faster, the capacitance of the condensor must be reduced. If the limits of adjustment of condensor C1 are insufficient, a capacitor C56 of the required value is installed. If the frequency cannot be adjusted even with capacitor C56 removed, the crystal must be changed. The normal operating mode of tube V1 is finally adjusted with potentiometer R12 and by selecting the proper value of resistor R13.

The next stage is adjustment of the reference frequency unit (section No 2), including three frequency dividers, as well as the shaper stage and blocking oscillator. This unit successfully divides the frequency of 1 MHz of the crystal oscillator 1,000 KHz: 4 = 250 KHz (tube V3), 250 KHz: 5 = = 50 KHz (tube V4), 50 KHz: 5 = 10 KHz (tube V5). To check the parameters of the unit, the output signal is fed to the X input of the oscilloscope, a 50 KHz oscillation from the R-154 receiver is fed to the Y input. A precise Lissajou figure with five peaks should appear on the screen, and when the "Kor. 1" button is pushed it should change to a circle.

If the figure is strongly distorted, one of the frequency dividers is not operating properly, and the stabilized 150-170 v voltage should be checked using the instrument in the power supply unit. After this, an attempt should be made to adjust the frequency dividers by replacing tubes V3, V4 and V5 in turn, then adjusting variable condensor C30 on the upper cover of the unit. If this is insufficient, which is quite rare, each divider must be adjusted individually.

The defective stage can be located as follows. Pull out tube V4 and, as in the preliminary check, tap the signal from its seventh pin and feed it to the input of the oscilloscope. If the figure is precise, check the next stage. Tube V4 is replaced and tube V5 is pulled out. The signal from its seventh pin is fed to the oscilloscope, producing a circle. If is greatly distorted, take another tube V4 and rotate condensor C30 until the divider operates properly.

If these efforts are unsuccessful, the section is removed and high frequency plug F7-11 is connected to it. Permanent capacitor C24 in the circuit is temporarily replaced by a variable condensor and it is determined over which limits of capacitance the divider is synchronized. The middle position of the rotor of the condensor is then found, the capacitance is measured by any available instrument and a constant capacitor of the proper capacitance is soldered into the circuit. If there is nothing with which to measure the capacitance of the condensor, the proper value is selected experimentally. Each of the three dividers is adjusted in this sequence. Practice has shown that the shaping stage and blocking generator rarely fail.

The supersonic oscillator unit (section No 3), like the quartz oscillator, must be checked regardless of whether the excitor as a whole is functioning or not, since the total frequency error and its output consists of the errors of these two oscillators. It should not exceed 50 Hz over its entire range.

The frequency of the supersonic oscillator is checked using its own crystal by placing the test switch in the position "Ind. II" and pressing the "Kor. II" button. The zero scale of the oscillator is put in the "AMO" mode and the shaft of variable condensor C18 is gradually rotated with the "Kor. II" button pressed until the needle indicators begins to "beat." After this, the calibration of the scale and point 10.00 of the first range are checked (also by "beating"). The divergence with the scale should not exceed 20 Hz (at point 5.00, this amounts to approximately 2 mm on the scale, at point 10.00 -- 5 mm). If the limits of adjustment of the variable condensor are insufficient, a permanent condensor of the proper size should be connected in parallel with it.

Adjustment of the frequency scale of the supersonic oscillator may be disrupted due to ageing of the condensor in the circuit. Therefore, the most effective means of its restoration is to unsolder the circuit and select a capacitor. This operation is quite difficult and cannot always be performed under field conditions. However, there are two methods to perform adjustments without unsoldering the circuit -- changing the location of installation and movement of the glass with the scratch on the ground screen.

Adjustment by changing installation is done by opening the screen of the unit on top and changing the position of the grounding wire relative to the variometer with an insulated screwdriver. Pushing the grounding wire closer is equivalent to decreasing the capacitance, moving it away is equivalent to increasing the capacitance. This adjustment has more influence on the frequency at the end of the scale, while moving the scratch influences the frequency at the middle of the scale. Each time, the zero on the scale must be reset. By using these two methods alternately, good correction can be achieved.

Sometimes the zero of the scale cannot be set by "beating," since there is no adjustment in the supersonic oscillator unit. To eliminate this defect, the unit is removed and connected with a repair line, high frequency plug P13 is connected and the VOM is used to measure the voltage on the pulse phase detector subunit. If the input voltages are normal (see Table 1), but there is no voltage atpin 1 or 3 of the plug, this means that the subunit is defective and must be replaced. When the voltage usually deviates from the norm due to a defect in the amplifier using tube V20 or breakdown of diodes D20-D32 in the frequency doublers.

The next important parameter which must be tested and adjusted is the frequency shift. However, frequency shifts can be measured precisely only using a frequency meter. A radio repair shop which does not have such an instrument can check only the matching of the frequency shift, 250 Hz in the second range, using the R-154 receiver. The radio set should be assembled, since the voltages causing frequency shifts are produced in the receiver. Manipulations are performed from the control panel. If the channel will not match with the receiver, the operating modes of tube V21 and diodes D25-D28 should be checked.

The smooth range oscillator unit (section No 1), including a large number of stages of various types, is complex in its operation and difficult to adjust. The operation of this entire large and complicated circuit can be checked using several output parameters.

The self-adjusting unit is removed and the VTVM is used to measure the necessary voltages at the high frequency plugs on its frame (see Table 2). If one of the voltages is absent, the diagram is traced to see where the voltage should come from and the stage suspected of being defective is checked. For example, there may be no voltage at pin P3-IV. The circuit indicates that this is the second intermediate frequency (112 KHz), the product of conversion of the frequency of the supplementary oscillator (V11) and the harmonic selector (V8). The lack of a signal at the anode of the mixer (V9) on the grid or cathode indicate the defective stage. Failure of the supplementary oscillator to oscillate can be determined from the resulting increased current of tube V11.

In case the self-tuning frequency is incorrect, the operating mode of reactive tube V10, the supplementary oscillator, must be checked. To do this, it is best to use a continuous range R-311 receiver, which is always available at the shop.

The sequence of testing is as follows. First wire T is disconnected, the input of the reactive tube is temporarily shorted to the chassis, which can be conveniently done as the point where it is connected to the "ChAP VKL" switch. Then a voltage of ±3 v, adjustable in both magnitude and direction, is fed to wire T. This voltage is decreased to zero, the lower frequency of the supplementary oscillator (1,318 KHz) is set, and the receiver is tuned to the frequency of the supplementary oscillator. The wire segment used as a receiver antenna is inserted into the variometer section of the supplementary oscillator. The master oscillator tube (V15) is pulled out.

TABLE 1.

Number of Plug Pin	Voltage, v	From
2	3	Frequency doubler
4	8	Anode tube V20
5	0	Body
6	12	Blocking oscillator
1	±1	Pulse-phase detector
3	-1.2	Pulse-phase detector

TABLE 2.

Plug Number	Voltage, v	Additional Information
F3-IV	0.1-0.4	Changes when frequency A is adjusted
F4-IV	2-7	Changes when "tuning" knob is rotated
F5-IV	3	From NTG f = 70-80 KHz
F6-IV	0.1	Varies with multivibrator frequency

TABLE 3.

Frequency of Supplementary Oscillator, KHz	Steepness of Reactive Tube, KHz/v	Asymmetry of Characteristic Not Over, Hz
1,318	0.9-1.1	250
2,818	1.8-2.2	500

The control voltage on the grid of the reactive tube is changed each 1 v and at the same time the frequency of the supplementary oscillator is measured on the scale of the receiver. The results are entered in the Table. The characteristics of the reactive tube are then measured: the frequency drift of the supplementary oscillator as a function of the control voltage

fed to the grid (see Table 3). The straight-line sector on the characteristic of the reactive tube should lie within the ±3 v limit. With a greater deviation of balance, the characteristics should be improved by adjusting the initial bias at the grid of the reactive tube by selecting the value of resistor R134. To increase or decrease the steepness, condensor C132 of the proper capacitance is selected.

In order to check the voltage at the output of the excitor, the VTVM is connected to its output and the output is loaded with an equivalent circuit consisting of a parallel 47 pf condensor and 27 Kohm resistor. While slowly rotating the adjustment knob, the indications of the VTVM are observed. The voltage in ranges II and III of the VT-23 excitor should be at least 150 v, in range I -- at least 100 v, the voltage of a type VT-53 excitor should be at least 150 v in all ranges. The ranges are switched by relay R12. In range I, it connects condensor C123 in parallel to the output stage circuit, and the stage operates in the amplification mode. In ranges II and III, the relay disconnects capacitor 123 and the stage operates as a master oscillator frequency doubler.

A few notes on the adjustment of the frequency self-tuning unit. The required values of voltage must be achieved first at the anode of tube V25 (about 2.5 v), then at the grid (about 0.4 v) and anode (between 7 and 8 v) of tube V24. Absence of voltage at the grid of tube V24 indicates a defective narrow-band filter (112 KHz). When relay R11 is replaced, recall that in VT-type excitors it may be either of two types: RP-4 (RS4.520.004) or RP-7 (RS4.521.002). Therefore, be sure to observe the marking of the panels of the relays removed and installed.

Adjustment of the excitor is usually completed by adjusting the contact groups. Most switches have two groups of terminal breakers, which open at the moment when the switches are put in place and close in a definite sequence. When the "test" button is pressed, the two end switches should open first. The main contacts of the switch, through which the tube currents are tested, should then close. When the switch button is released, the contacts operate in the reverse order. To check the contacts, the range oscillator unit is removed and the forces are adjusted with a special tool or wires. Closing of the contact is checked with an ohmmeter.

Functioning of the contact groups of the "Kor. 1" and "Ind. 1" buttons can be checked visually. Each of these buttons contains four contact groups for switching. When the buttons are pressed, the opening contacts operate first, followed by the closing contacts. There should not be a moment when all three contacts are closed to each other, since this will cause the meter to fail.

If this method for adjustment and regulation of the VT excitors is followed, the initial parameters of communications equipment can be restored with minimum expenditures of time.

TEACH TECHNICAL CREATIVITY

Reserve Engineer Colonel A. Yezhov pp 34-35

Our military training schools have been given the task of increasing the quality of training of military troops comprehensively, including military engineers, capable of performing complex and responsible tasks as set forth by the Communist Party before the Armed Forces. This was discussed in the report of the Minister of Defense of the USSR, Marshal of the Soviet Union A. A. Grechko, at the All-Army Conference of Military School Administrators, and in the presentations of participants at this conference.

It is quite obvious that the training of a specialist, the engineering knowledge he has, his organizational capabilities and practical skills in working with the combat equipment will determine to a great extent his successful work in the Armed Forces. Therefore, the professors and teachers of military academies and schools must instill these skills in the future engineers, developing in them creative thought and forming high morale, combat and Commanders qualities.

The creative abilities and technical thinking develop gradually as knowledge and experience are accumulated. Many years of experience have convinced us that this process is facilitated to a tremendous extent by active involvement of students in technical creativity -- inventions and rationalizers work. Many well-known military scientists and inventors recall that the rationalizers work which they undertook in their first years of training contributed a great deal to their success. This work teaches us to observe the latest innovations in technology constantly and carefully, to use theoretical knowledge in practice.

It is also doubtless that the participation in technical creativity makes training more successful. As a rule, rationalizers study the combat equipment more thoroughly, penetrating to the very essence of the physical phenomena and processes occurring in the units and circuits. They are helped in this by the most experienced teachers. For example, an instructor at one military academy, V. Yanovskiy, always recalls the "bright spots" in

science and technology in his lectures, teaching his students to evaluate various circuits and design decisions critically. It is quite natural that his students attempt to test their skills, to find new solutions. For example, students V. Belomyttsev and G. Solondayev developed a coding device based on a parametron. The novelty of the device which they created allowed them to make up an application for an invention and receive an Author's Certificate. The coding device formed the basis of a new laboratory installation, the design of which involved the participation of junior students.

The same thing is done by other teachers. In particular, instructor A. Polishchuk recommended that student L. Baranov develop a table vibrator. In order to find the proper solution, the future engineer had to read a great deal of additional literature, to penetrate deeply into the problem. As a result, he not only made the required device. The inventor became more confident of his own creative abilities. Working in the training laboratory on his first rationalizers suggestion, discussing the problem with experienced engineers and technicians, he felt the need to develop a number of other training devices. Later, the young rationalizer created a deformation meter and an attachment for a tape recorder. As he accumulated experience, his confidence in making technical decisions grew. Working with the literature, L. Baranov gained skill in referring to large quantities of information. This was expressed in the summary which he read on the theme "Technical Recognition Devices." On the example of his training division, he convincingly demonstrated and scientifically proved the positive influence of teaching machines on the success rate of students.

A good test of the creative abilities of students consists of their course and diploma plans. During this time, they can demonstrate in practice the material of their technical thought. For example, during diploma planning, student B. Isakov, together with his colleagues in the department, developed and manufactured a trainer which became a component part of a complex trainer, later put into series production. This development, originally presented as a rationalizers suggestion and, incidentally, acknowledged as the best in the department, clearly showed the ability of its author to apply his knowledge in practice. According to his assignment, he could have limited himself to theoretical development of the schematic diagram and calculation of its parameters. However, this innovator decided to bring his idea to life. By doing this, he demonstrated his ability not only in planning technical devices, but in manufacturing and adjusting equipment -- qualities so necessary for a military engineer.

It has become a tradition at this academy to involve the students in rationalizers work during their production practice and military service. As a rule, Party meetings are held in the departments with the active Party members of the course, discussing the tasks of Communism during the immediate future. Open Party Meetings are held with the students with the same agenda.

Groups of students formed during practice or OJT are assigned responsibility for rationalizers work, which is continued in contact with the Commissions

on Invention upon arrival at the Chast', where the themes assigned to the military Chast' are refined, generally long before the beginning of the OJT begins. Due to this, some students arrive at their units with their technical solutions almost prepared, then need only check them in practice. For example, students V. Talanov, V. Paukov, S. Dolgalev, under the scientific leadership of instructor Ye. Mikhno, made five to seven rationalizers suggestions each during their OJT.

In one year alone, the students turned in 719 rationalizers suggestions, 57 of which were used in the laboratories of the academy, 622 -- in the units and industrial enterprises. In particular, the boiler at one Chast' was redesigned according to a plan submitted by student B. Boychenko, allowing a savings of several thousands of rubles. Thousands of rubles were also saved due to the introduction of a suggestion developed by student P. Melkumyan. Introduction of the suggestion of student V. Polyakov reduced the time required for adjustment operations almost in half.

A great deal of attention is also turned to helping the students rise to the highest level of technical creativity -- becoming inventors. Experienced officers B. Titkov, N. Senin, V. Rinas, I. Panfilov and others read lectures on the themes: "The basic content of an invention," "the use of the patent literature," "composition of applications for patents," etc. Teacher-inventors are assigned to groups of students as consultants on problems of patents and inventions.

All of this has doubtless influence to the results: in one year alone, students filed 64 applications for inventions and received 16 Author's Certificates and decisions for issuance of Author's Certificates. For example, student I. Prosin invented a phototelevision device, S. Sharov invented an independent self-tuning system, etc.

On the initiative of one of the best inventors of the academy, Doctor of Technical Sciences B. Titkov, the author of 25 inventions, a Komsomol Public Patent Bureau has been set up. It consists of students Ye. Shabakov, V. Popov and I. Prosin. B. Titkov has discussed with them how to formulate an application, how to seek the required information in the patent library. The members of the Komsomol Public Patent Bureau have turned in 18 applications for inventions in the past year, and have already received the decision for issuance of Author's Certificates for 4 of them.

Doctor of Technical Sciences L. Kargu, the author of over 30 inventions, is a great help in the formulation of applications by the students. He tries to help the students understand the principles of inventors work and helps them to organize their work in the military Chast' where they will serve. Almost every diploma project made under his leadership is accompanied by an application for an invention. For example, students officers V. Prokopovich and Yu. Prokin turned in three applications for inventions. Student officer B. Kosarev, together with his leader, received an Author's Certificate for an element developed as a part of an operating model for variable structure test organs.

The development of technical creativity among the students is greatly influenced by the capable organization of socialist competition, the proper organization of material stimulus and particularly moral stimulus, and the conduct of massive measures such as competitions, inspections, conferences and exhibits on inventions.

Development of the creative abilities of students, our experience has shown, can be successful if this multifaceted work is guided daily by the leaders of the military educational institutions, departments, Party and Komsomol organizations and if it is actively participated in not only by the Commission on Inventions, but also by the military scientific society, the public patent bureau and all of the professors and teachers.

T AND A ORDER DEPARTMENT

Orders: p 35

38. Captain S. Novak: I would like to know whether any training objects with multiplexed control channels for the target situation have been developed.

39. Major Yu. Tsyganov: We are interested in a pump for pumping of paint and varnish materials from barrels and cans.

Order Filled

Lt. Col. Yakovlev (No 1, 1972) was interested in duplex communications equipment to be used between the watch officer and sentries guarding an object by patroling.

A system providing two-way audio signaling and telephone communications has been developed by Senior Lt. V. Kuznetsov.

Three terminal devices are set up along the patrol path. At each of these there is a bell, signal buttons and a plug for connection of a telephone head set.

The sentry can give an established sound signal to the guardroom by pressing on the button (which simultaneously turns on lamps on the electrical post system), or may put himself in telephone communications with the Chief of the Guard. For this purpose, he carries a telephone hand set from the TAI-43 Army telephone apparatus. When the plug is placed in the jack, a relay closes and turns on the bell at the post of the Chief of the Guard.

The call signal stops when the Chief of the Guard picks up his telephone hand set. The telephone signal passes through the winding of the relay, connected in series with the two hand sets.

The guard can be called from the guardroom by pressing a button corresponding to the post number.

A loudspeaker is installed in the room where the off duty guards sleep. A low frequency vacuum tube amplifier is included in the circuit to power the speaker.

The circuit can be powered by alternating current through a transformer or by a 12 v battery.

The communications lines are underground lines made of type TTVK 5 × 2 cable.

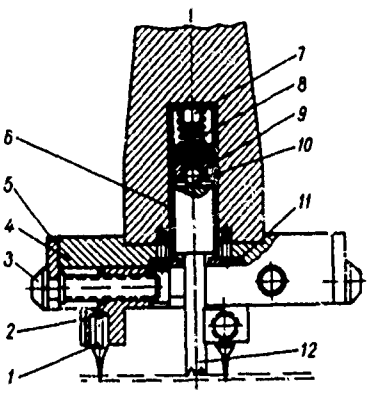
One advantage of this system is its reliability, resulting from the duplex telephone and signal connections. Furthermore, the telephone system allows [illegible] messages to be transmitted without error, while the electrical [illegible] the origin of a signal to be determined rapidly.

RECOMMENDED FOR INTRODUCTION

Unsigned p 36

Device for cutting gaskets from 9 to 30 mm in diameter, designed to fit the chuck of a drill. It consists of body 4, in which holders 2 and blades 1 move. The blades are adjusted to the required gasket size by means of screw 3, resting against stop 5. The screw thread allows cutting to be performed with high accuracy (0.05 mm).

Center 12, moving in bushing 6 is pressed by spring 8 against the central circle of the fitting. The spring is centered by plate 7 and rests against stop 9 and ball 10. Plate 11 holds the center to prevent it from falling from the chuck.



Device for testing stretching of bellows, allowing the productivity of labor, effectiveness and accuracy of testing to be increased.

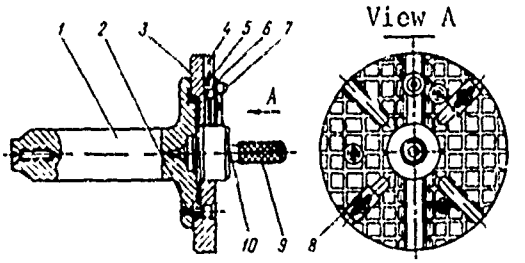
It consists of base 1 and column 2, carrying bracket 5. Bracket 7 carries indicator 6, the blade of which rests in the arm of tip 8, set on the

flat area of yoke 3 and matched to the axis of the bellows. One end of the yoke is connected to the bellows, the other end to force meter 9 (a standard dynamometer), designed to measure the load during testing of bellows.

For testing, the bellows is set in bracket 5 and held with clamp 4. By turning wheel 12 to the left, force 11 with dynamometer 9 is lifted upward. The force is transmitted through support 10 to the yoke. The bellows is deformed as required and the force is measured in kilograms.

After this the load is released and the test is completed.

Technical data of the device are as follows: maximum operating force -- 10 kg, measurement scale division -- 0.01 mm, error -- 1%, size 320 × × 300 × 200 mm, weight -- 8 kg.



A device which sets precise distances between centers of apertures being ground is set in the spindle of an internal grinding machine and fastened by a tamping bar.

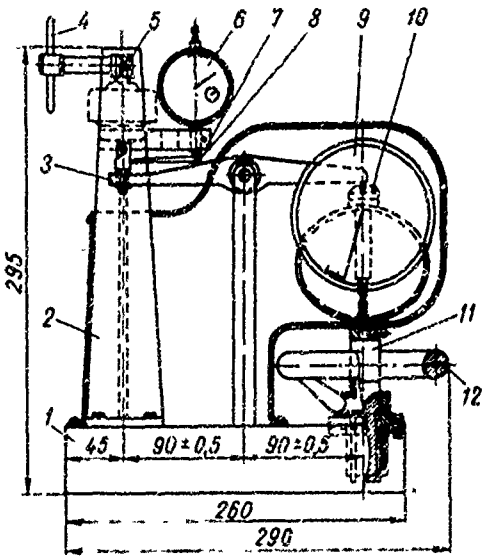
Face plate 3, the working surface of which is divided into squares 20 mm on a side, is held onto support 1 by screws 2. The face plate has one slot which goes clear through and four blind T-shaped slots. Movable stop 7 is attached in the through slot by means of nuts 4 and 5 and moving sleeve 6. Clamps 8 move in the blind slots.

In order to achieve the required distance between centers of apertures in a model being worked, standard plug 9 is set in the central aperture of the face plate. Block 10 of the required size is selected from the plane-parallel plates, considering the actual dimensions of the standard plug, the circular stop and the errors in the plates of the unit, as indicated in the certificate of the set. The circular stop is set and fastened so that the unit of plates enters between the stop and the standard plug without clearance, yet not too tightly. After adjustment, the plate unit and standard plug are removed. The model is placed on the circular holder, tightened with the clamps and grinding of the central aperture is begun.

Introduction of this device significantly increased the accuracy of models, improved the smoothness and geometric shape of base central apertures. The productivity of labor was increased by 8 to 10 times.

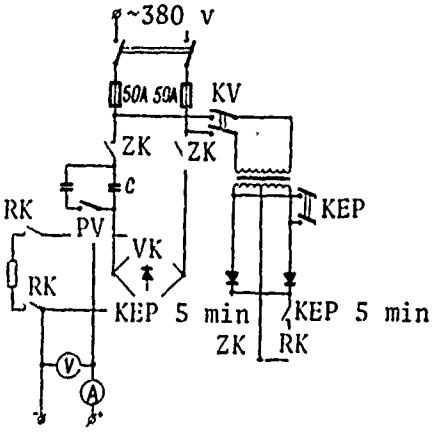
This device is simple in design and can be manufactured in repair Chast' and enterprises where parts or stamps are produced in which great smoothness of working of apertures and accuracy of placement between their centers must be maintained.

The device has been introduced at the Uralelektrotyazhmash Plant imeni V. I. Lenin (Sverdlovsk).



Automatic charger and discharger for alkaline batteries, simple and reliable in operation, reduces the time of a training cycle, increases battery charging quality and lengthens their service life.

The power circuit of the charging unit consists of a current-limiting capacitor (two parallel condensors type KM-0.5-1, connected through a packet switch), a rectifying bridge consisting of four VKD-200 diodes with natural cooling, charging and discharging contacts (ZK and RK), a discharging resistor and current measuring devices. The control circuit consists of a 380/55 × 2 reducing transformer, a selenium rectifier and a KEP-12U time-delay relay with microelectric motor drive; button switches are provided for the KEP and transformer.



Charging current is stabilized by a buffer capacitive resistor of 13 ohms, connected in series with the battery. Since the voltage of the battery changes little during charging in comparison with the supply voltage, the charging current is determined primarily by the capacitive component.

The basic operating mode of the installation is automatic charging using current of variable polarity. After the battery is connected to the installation, the control circuits and KEP time relay are switched on. The battery begins to be charged from the 380 v circuit through the contacts of the charging contactor, the capacitor and the rectifying bridge. The KEP contacts are adjusted to 5 minutes and 20 seconds. After 5 minutes of blocking of the KEP, the charge contact is disconnected and the discharge contact is connected, the battery is discharged for 20 seconds through the resistor, after which the process is repeated. The installation can be set in the training cycle or the ordinary mode.

The device is manufactured by the locomotive depot of the Lyangasov-Gor'kovskaya Railroad.

MECHANIZATION OF WATER SUPPLY

G. Vasil'yev p 37

Soon after the XXIV Party Congress, the CC CPSU and the Council of Ministers, USSR issued a resolution "on measures for further development of land improvement and agricultural land use, 1971-1975." The resolution calls for the State to invest the capital required to reclaim 8 million hectares of land, i.e., 1.5 times more than in the preceding five-year planned, including 3 million hectares of irrigated land and 5 million hectares of dried land. Furthermore, 41.2 million hectares of pasture are to be irrigated and the quality of 3.77 million hectares is to be improved.

Successful performance of these tasks will require production of large numbers of excavators, bulldozers, scrapers, heavy tractors, as well as machines allowing total mechanization of water supply.

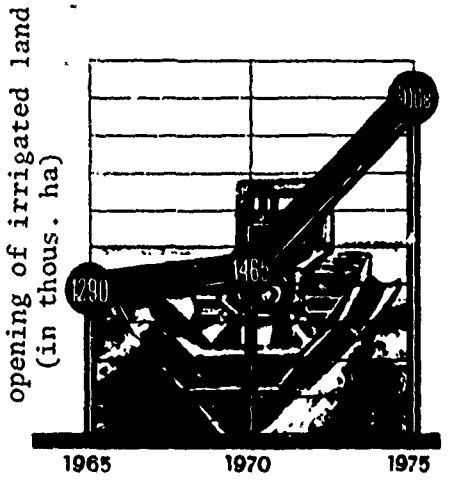
These machines are being demonstrated at the pavilions of the Exhibition of Achievements of the National Economy, USSR. The UGB-50M, URB-ZAM-OP drilling machines, the 1BA15v self-propelled drilling machine, UKS-22M-RPM drilling machine and many others are designed to search out water-bearing layers and drill wells. They all have such qualities as high drilling rate, maneuverability and economy. They can drill wells of various diameters, up to 0.9 m. By feeding wash water between the drilling column and the walls of the well, additional hydrostatic pressure is created, increasing wall stability. Consequently, the walls need not be stabilized by casing strings.

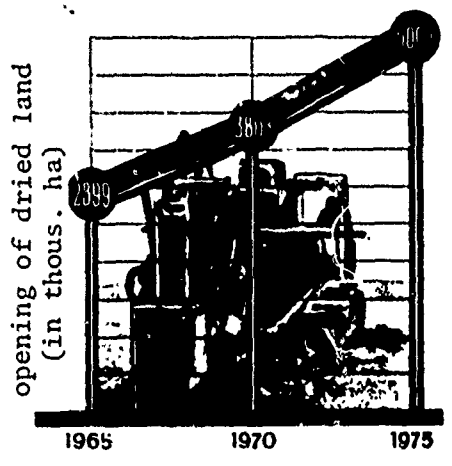
The 1BA15v drilling unit, mounted on a truck with high cross country ability, carries everything necessary to drill wells up to 500 m deep. Equipped with two engines, it is reliable and has a great reserve of power. Pneumatic control of the basic mechanisms greatly eases the labor of drillers.

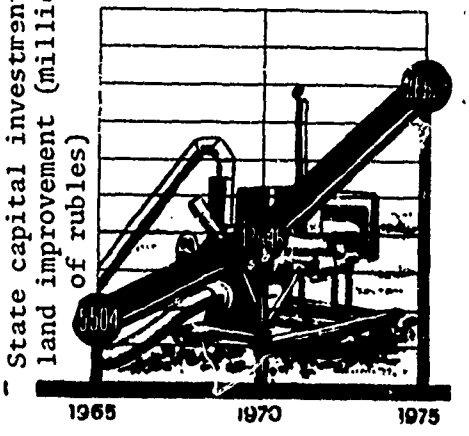
Various mechanisms used to lift water from the ground are also demonstrated at the pavilions of the Exhibition. These include the self-propelled

AO unit, mounted on a truck chassis, capable of pumping water by one of two pumps submerged in the well at rates of up to 40 m^3/hr. Electric power is supplied by a portable generator installed on a trailer.

The construction of shaft wells is one of the commonest methods of irrigating fields. With low water output of the water-bearing horizon and if this horizon is not very thick, shaft wells have significant advantages over tube wells due to their ability to reserve water. The process of digging of shaft wells has now been completely mechanized. In regions where water lies at a depth of 5 to 30 m in lose deposits, the modernized KShK-30M unit can be successfully used for this purpose, allowing full mechanization of the process of digging of shaft wells. It digs shafts up to 35 m deep and 1.25-1.30 m in diameter at 1.0-1.15 m/hr. Shaft wells can reserve water with low water output of the water bearing horizon and when this horizon is not very thick.







Water can be raised from shaft wells using the PPV-30 installation, the VShP-50 and VLM-100 water lifting units or the DN-50M diaphragm pump. They are all simple in design and convenient to use. They can be used on open areas at anytime of year.

The PPV-30 mobile water lifting unit consists of a pneumatic submersible pump, a mechanical winch, a power takeoff unit and a compressor. Mounted on a type UAZ-452D truck chassis, the installation has good cross country ability, which is very important in areas without roads. It requires only 20 to 25 minutes to set up. The PPV-30 can serve 6 to 8 wells per shift, separated by distances of 10 to 30 km from each other. The pump of the installation delivers up to 7.3 m^3/hr from wells at least 0.5 m in diameter, at depths up to 30 m.

The DN-50M diaphragm pump is very reliable in operation. During operation, its friction joints and parts do not contact the water. This allows water to be pumped together with sand, i.e., allows cleaning of the source of water at the same time the water is removed. The pump creates high water pressure, can pump it over great distances and even force it into water towers. The engine operating life is over 6,000 hours.

The Exhibition dedicated to the 50th Anniversary of the formation of the USSR clearly indicates that the great economic potential of our country, accelerated development of branches of industry producing the means of production for kolkhoz and sovkhoz fields are an investment for successful fulfillment of the tasks set forth by the XXIV CPSU Congress. The selfless labor of the activists of science and technology, workers of industry and of the land will assure further development of the agriculture of our country.

CONTRIBUTIONS OF YOUTH TO THE NATIONAL ECONOMY

Lt. Col. N. Shcherbanenko, Senior Inspector for Inventions, Order of Lenin Moscow Military District pp 38-39

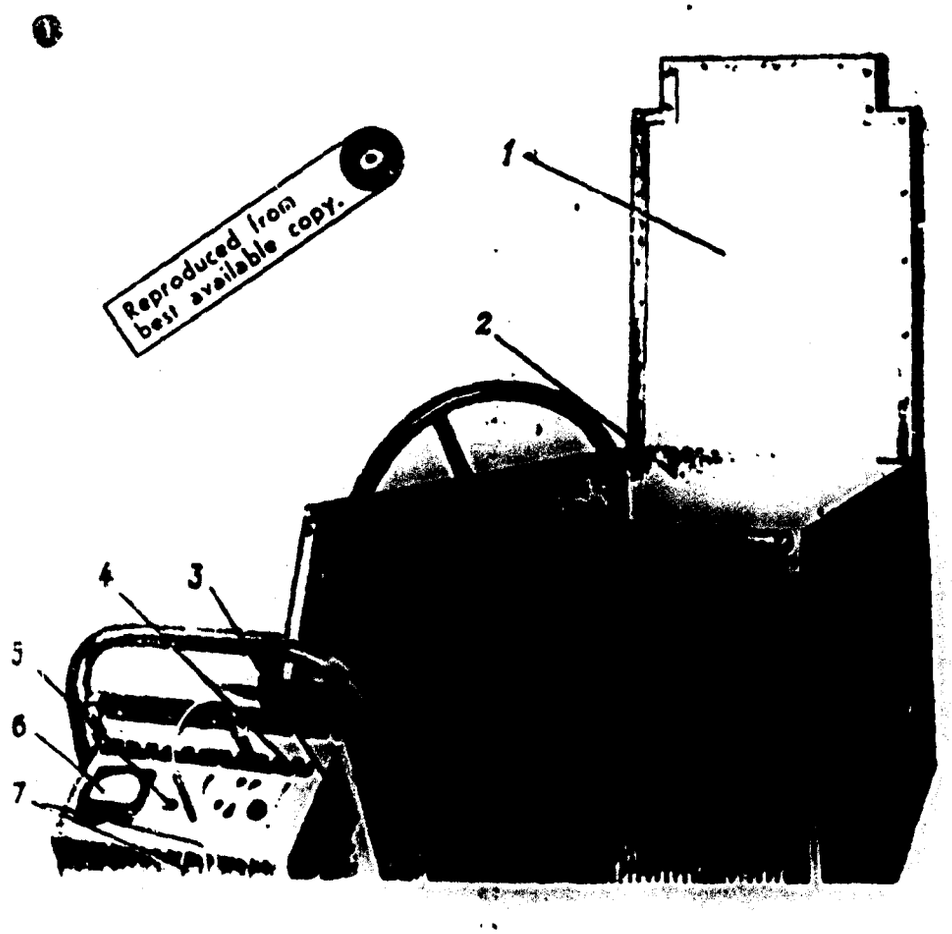
Many technical innovations helping to improve the means and methods of operation, conservation and repair of equipment, to improve the quality of technical training of the troops, have been created by the young innovators of the Order of Lenin Moscow Military District. Exhibitions of technical creativity organized for participants of the conference of rationalizers held in the units in the district included over 30% exhibits by young people. Some of their work is of significant interest for the national economy and worthy of being shown at the upcoming central exhibition of scientific and technical creativity of youth, dedicated to the 50th Anniversary of Formation of the USSR.

Great work on the solution of exhibits for this exhibition has been performed at the Tamanskaya Guard Battalion imeni M. I. Kalinin. At a conference of rationalizers held ever recently, the Assistant Chief of the Political Section of the Battalion for Komsomol work, guards Captain I. Bogovik, explained the purposes and tasks of the All-Union Inspection of Scientific and Technical Creativity to young people, and called upon them to take part in it actively.

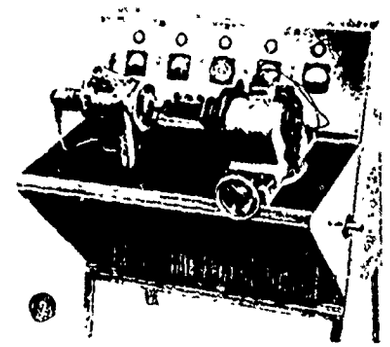
Over 20 interesting suggestions of young rationalizers were exhibited at the conference. For example, a device for checking the excitation of a generator suggested by Sergeant Yu. Denisov and device developed by A. Staposel'skiy allowing a qualitative improvement and acceleration of charging of batteries were recommended for the exhibition of scientific and technical creativity of youth. There is significant interest in a trainer for testing the reactions of drivers to changing road situations (Figure 1), developed by Pfc. A. Kononov, Pfc. A. Panfil' and Pfc. A. Abramov.

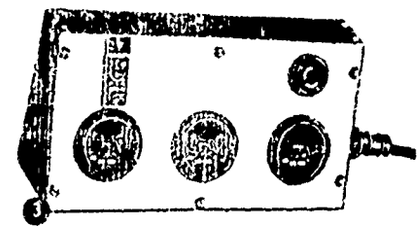
This trainer consists of screen 1, on which an image of the road is projected from screen 2. Behind the driver seat is control panel 3. The

screen shows signs, to which the driver is to react by performing the proper actions. At the same time that a sign is displayed, electronic stopwatch 6 is switched on, and after the driver performs the correct action, the sign goes out and the stopwatch is stopped. The norm for performance of the entire program of 5 tasks is 4 seconds (0.8 sec per sign). The program is selected by placing plug 7 into jacks 4. Switch 5 starts and stops the device. After completion of a test or training session, the driver can see the results of his work on the stopwatch.



The Moscow Higher All-Service Command School imeni the Supreme Soviet of the RSFSR is also actively preparing for the central exhibition. The Commission on Inventions has inspected the technical creativity of the young rationalizers and selected the exhibits. A universal stand for testing and adjustment of the electrical equipment of wheeled and tracked vehicles (Figure 2), designed by Senior Lieutenant-Engineer A. Vonsovskiy and Private V. Aseyev has been recommended to be shown. The stand allows the operation characteristics of generators to be tested, as well as the operation and adjustment of voltage regulators of all types. Using this stand, the time required to test repair generators and voltage regulators can be significantly reduced.





The stand differs from existing devices in that the generator is rotated through a flexible clutch made of a rubber hose and two heads made of socket wrenches. The electric drive motor is an automobile generator with the poles switched. The generator being tested is installed using special centering clamps. The rotating speed of the generator is determined using an electrical tachometer. The test stand is simple in operation and can be manufactured at any vehicle repair base using standard motor vehicle units.

A remote control device for testing the operation of a heating system in the hot boxes (storage areas) of motor pools (Figure 3), suggested by Engineer Senior Lieutenant A. Vonsovskiy and Private V. Mal'tsev has also been selected to be shown. The device allows the system of heating of all hot boxes to be controlled from the duty room during the winter, and also checks the temperature water used to fill the cooling systems of vehicles. It consists of three TM-101 temperature sensors, a control panel with three UK-202 temperature indicators, switches and control lights. Two of the temperature sensors are installed in the heating radiators, one for each hot box, while the third is installed in the unit distributing hot water from the boiler. This sensor shows the temperature water ready for distribution. All sensors and their points of attachment are insulated. The measurement error is 5%.

The suggestion of Engineer Senior Lieutenant A. Tsarev for a semi-automatic device with a moving truck for cleaning and painting of vertical surfaces has been selected for exhibition. It assures high productivity of labor during removal of rust, scale and old paint from metal surfaces, particularly stationary vertical steel reservoirs for fuel storage.

Some 10 original designs by young rationalizers at the Gor'kiy and Ryazan' Higher Military Schools have been selected for exhibition. The specialists conclude that these devices can be used at industrial plants, in machine repair shops, civilian schools, motor pools and construction areas. For example, two suggestions of one active rationalizer at the Gor'kiy Military Communications School, Junior Sergeant V. Fedotov, have been selected -- a signal receiver for calling of duty specialists and a device for checking electron tubes directly in the equipment in which they operate. The rocking frequency generator developed by a teacher at the same school, Engineer Lieutenant A. Vederkin, will also be of interest to visitors to the exhibition.

BRIEF CORRESPONDENCE

Minimum Expenditures -- Maximum Effect

Major A. Yakovlev p 39

At the Party Meeting of one Podrazdeleniye, the men were discussing the necessity of creating teaching machines and equipping classrooms with good visual aids. A report on this problem was read by Party Secretary Major Zh. Starinskiy. The Communists unanimously approved the report.

Soon a group was set up in the Podrazdeleniye including active rationalizers, troops who were familiar with the installation of radio equipment, including highly qualified specialists such as Captain S. Gorbunov, Sergeants V. Vodop'yanov and M. Zayets, Privates A. Kovalenko, M. Knyazev and others. A plan was drawn up and times for performance were decided.

Three months later, the cumbersome tables with radio parts and models were replaced by cabinets. The movable shelves in these cabinets can carry significantly more radio parts to be demonstrated at drills. The demonstration circuits, made on stiff paper, can be easily rolled up into tubes and inserted in special slots. This allows the walls to be used for powered circuits and models, also made by the men in the unit. Whereas earlier the drill leader, explaining a functional diagram of a transmittor, drew it on the board, he now need only press one of the buttons on the control panel and light signal indicate the circuit of the unit being studied on the powered diagram. The diagram of a radar is just as clearly shown. Using this diagram, the students can easily trace the path of a pulse through each stage, and also see the processes occurring in the circuit in various operating modes.

In one room, the rationalizers of the Podrazdeleniye -- Captain S. Gorbunov, Sergeant V. Titov and Private I. Chistyakov have done a great deal for the individual study of the troops: an operating model of an electric power drive, a diagram of cable connections, a powered plan of the lubrication of friction surfaces have been set up. The troops who must reinforce their knowledge come to this room to study and to learn more about the operation of the individual units.

A trainer for testing the functioning of apparatus is very helpful. Four students with different levels of training can be trained on this apparatus simultaneously. It consists of a control panel and four units completely imitating the operation of the combat equipment.

The classrooms are not empty during the hours set aside for independent study. They have become a center for the study of highly qualified specialists. The rationalizers also work here on their inventions.

Everything done in the Podrazdeleniye -- models, diagrams, stands -- has been done by the men with minimum expenditures.

The creation of technical training equipment helps the personnel to study more successfully. The Podrazdeleniye now includes 40% men rated outstanding in combat and political training, every second operator is a highest one or two specialists. Many troops have mastered related specialties and achieved full interchangeability.

Exhibitions Selected

The young rationalizers of the twice Red Banner Baltic Fleet were very happy to read the announcement of the CC Komsomol, the Committee for the Exhibition of Achievements of the National Economy, the Presidium of the All-Union Council of Scientific and Technical Societies and the Presidium of the Central Council of the All-Union Society of Inventions and Rationalizers of the All-Union Inspection of Scientific and Technical Creativity of Youth, held within the framework of the Patriotic Movement "The Five-Year Plan -- hard work, mastery and research by youth!"

An organizational committee has been set up in the fleet, chaired by Engineer Rear Admiral I. Zheleznov, a plan of measures has been worked out, in which the times and specific persons are indicated, and in an article "for the scientific and technical creativity of youth."

The rationalizers work for the first quarter of 1972 has been summarized, exhibitions of technical creativity have been held, socialist competition has been broadly developed, dedicated to the 50th Anniversary of the Formation of the USSR.

Exhibits have been selected in the Chast' which are to be recommended for showing at the central exhibition of scientific and technical creativity of youth. They are quite varied. In the Chast' where the Secretary of the Commission for Inventions is Major of Technical Service V. Buyalov, for

example, it has been decided that the rationalizers suggestion of 24 year old lieutenant A. P. [illegible] radio station trainer" should be exhibited. The trainer imitates [illegible] station and allows the training exercises [illegible] be [illegible] This suggestion will doubtless interest [illegible] schools and technical schools.

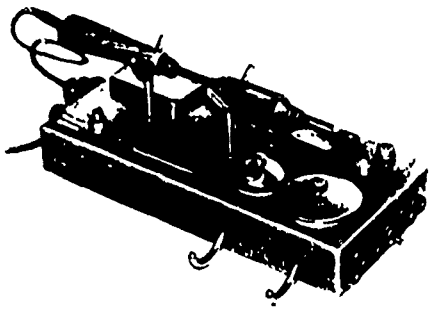
Ye. Pikhulya,
Chief of Bureau of Inventions,
Twice Red Banner Baltic Fleet

EXHIBITION OF THE INNOVATORS

Unsigned pp 40-41

In August of 1972, the Central Exhibition of the Scientific and Technical Creativity of Youth, dedicated to the 50th Anniversary of the USSR, will open in the pavilions of the exhibition of achievements of the national economy of the USSR. This All-Union inspection will include the active participation of young inventors and rationalizers in the Army and Navy.

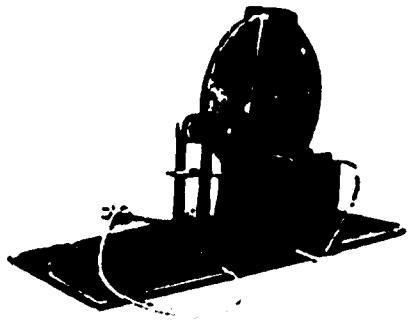
Today, the exhibition of innovators publishes some brief descriptions of some of the work of Army innovators to be shown at the Central Exhibition.



Universal Support

Invented by V. Nechiporenko

Allows a 36 v soldering iron to be heated to the required temperature and also allows analysis of electrical circuits and separation of wire ends by heating. Can be used during installation and repair of electronic apparatus of all types, including printed circuit units.

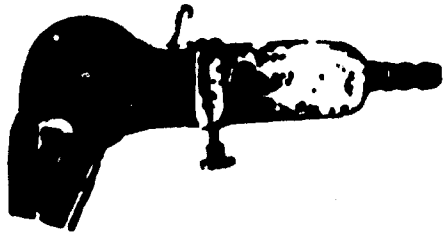


Semi-automatic Marker

Invented by A. Gubanov

Can mark vinylchloride tubing and paper tape. Consists of support, polar mechanism, guides and electric motor. Interchangeable disks designed for marking of vinylchloride tubes of various diameters: 3-8, 8-14 and 14-25 mm. Power supply -- 220 v.

This device reduces labor expenditure by almost 20 times.



A Pneumodynamic Device

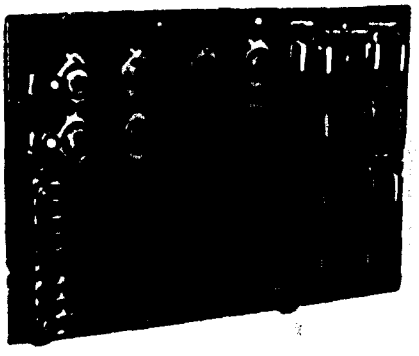
Invented by I. Belotelov, V. Zenushkin, O. Mel'nikov and A. Kazin

Designed for hardening of parts by a directed stream of steel shot. The body contains all elements of the device and the air line connection. Basic elements: body of working chamber, shaped central body, shaped nozzle, perforated side covers, interchangeable tips, trap and slides.

The channel in the working chamber, formed by the internal surface of the body of the working chamber, central body and interchangeable tip, consists of three parts. The acceleration sector features high velocity and pressure of the air stream. In the nozzle sector, the air is vented into the atmosphere, and in the ejection sector, in the area of the tip of the nozzle and beginning of the acceleration sector, the flow of compressed air is accelerated. The trap is a chamber for collection of the steel balls. It is separated from the working chamber by the slide.

The productivity of the installation, as well as the impact force of the balls and, consequently, the depth of strain hardening, can be changed by changing the air pressure and depend on the geometric parameters of the channel and diameter of the nozzle.

The device is portable. It allows hardening of parts of complex shape.

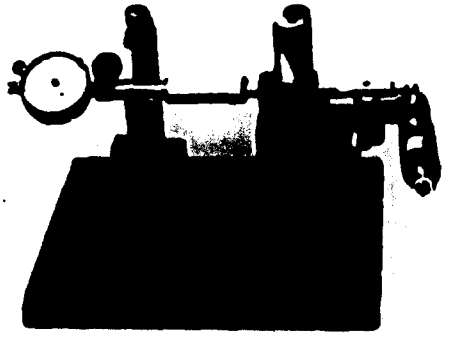


Contactless Counter

Invented by O. Vorkin and A. Zinov'yev

This counter is designed for visual indication of the ordinal number of an instruction. It can be used to check the rate of transmission of instructions, and also to count the number of parts made in a shift.

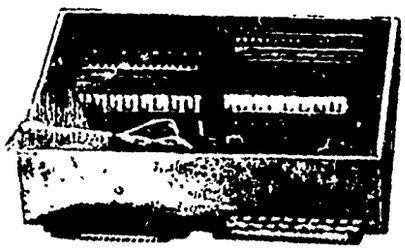
The counter differs favorably from similar devices using stepping switches. It is smaller and lighter, has higher reliability and creates no electrical interference. It includes knowing basic functional units: the starting and memory devices, decombinator, combinator, dc amplifiers, indicator lamps, subtraction circuits, clearing circuit and power supply. It consists of four units: the starting and power supply units and two plates.



Device for Testing Indicator Inside Calibers

Invented by P. Tikhevich

This device consists of a steel plate with uprights. Two of them with clamps (one moving) are used to install the indicator caliber being tested, while the third (moving) carries a micrometer (0-25 mm) which is installed in the required positions before measurements. The device allows rapid, precise checking.

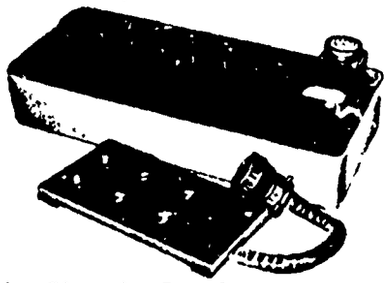


Computer Trainer

Invented by N. Pakulov, S. Bessonov and Ye. Mikin

This device is used for practical study of the structure and operating algorithms of various electronic computer devices and accumulation of skills in working with control panels of these machines. It can be combined with any second generation computer.

The trainer models any computer device, requiring only that an operating program be composed and a special mask made to cover the control panel. The power consumption is 1.2 w, dimension 340 × 440 × 140 mm, weight -- 4 kg.



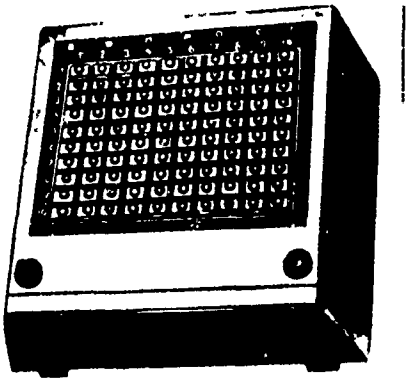
Panel to Check Automatic Circuit Breaker

Invented by L. Logvinenko

The device has three sections and is designed as an accessory to the type U353-59 test stand. The first, basic unit is designed to check automatic breakers at 20 ± 5°C, the second for setting of breakers at 50°C.

The panel can simultaneously check six breakers for the following identical nominals: 2, 5, 10, 15, 20, 30 and 40 a.

Dimensions of the panel are 100 × 270 × 600 mm. Weight is 3.5 kg.



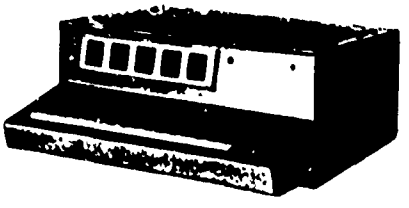
A Self-Testing Stand

Invented by A. Mikhnushev, I. Gokhman, N. Kononenko, N. Tarasun, G. Baklan, Z. Kuz'mina and V. Stankevich

This device allows students to test their own knowledge on various subjects. During independent study, three men can use the device simultaneously. Each performs his own version of the assignment, consisting of ten test questions.

The answers are input by numerical code. The operating principle of the stand is based on optical-mechanical conversion of binary numbers.

The answers are recorded by the rod of a pusher which passes through apertures in a mask. To check the answers, the "result" button is pushed, and line voltages fed to signal lamps.

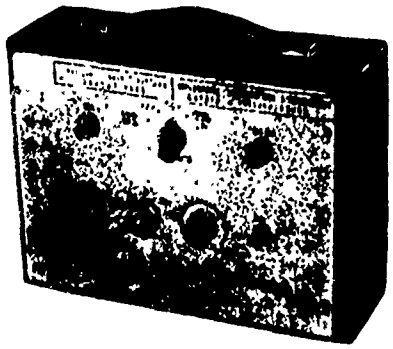


A Code Convertor

Invented by A. Kochka, Ye. Mishchenko, I. Marshubin

This device automatically converts sixteen-bit binary code to five-digit decimal code. It significantly increases the effectiveness of computation in the performance of programming tasks. It can also be used as a portable display unit for the output information of digital machines operating in binary.

The convertor consists entirely of modules and semiconductor devices in the form of a portable keyboard instrument. It weighs 11 kg, measures 385 × 385 × 165 mm and consumes 40 w of electric power. A sixteen-bit binary number is converted to decimal in two seconds.

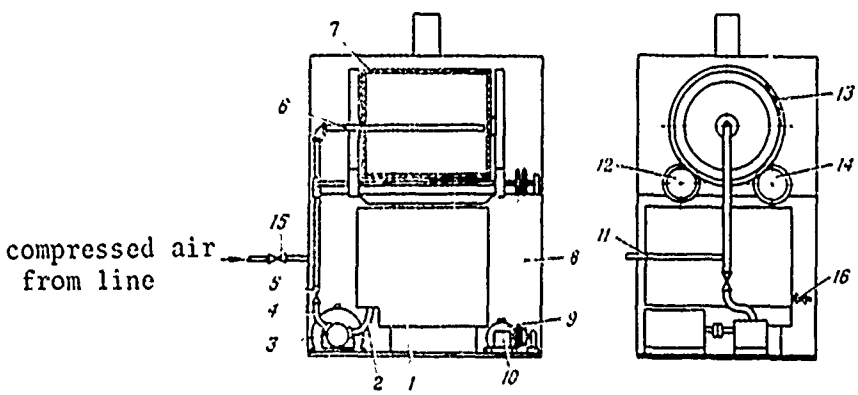


Transistor Tester

Invented by Yu. Vitchenko and V. Shibayev

This device is used to measure the output characteristics of low and medium power transistors, the volt-ampere characteristics of semiconductor diodes and stabilitrons. The set of output characteristics can be used to determine the area of linearity, permissible dissipated power, saturation voltage, working point, electric breakdown voltage, and also to select identical pairs of transistors for operation in push-pull circuits. The volt-ampere characteristics allow determination of the stabilization voltage, change in stabilization voltage with changing load current, time and temperature in stability.

The device is small in size. It is transistorized. It is powered by a 220/127 v ac line, power consumption is 6 w. The standard MP-40 transistors and D-808 stabilitron allow rapid calibration of the device.



An Installation for Washing of Parts of electrical equipment in white spirit with subsequent drying has been developed by Engineer Lt. Col. P. Yanchuk and Soviet Army employee P. Atamanyuk.

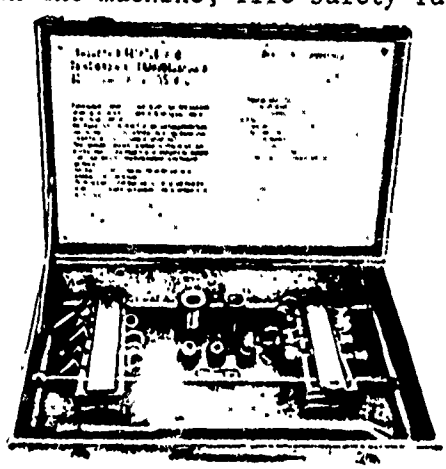
The device is a metal welded structure consisting of 300 liter tank 1 for storage of the washing fluid, input through line 2, pump 3 with its electric motor, delivery line 4 with valve 5, spraying tube 6, drum 7 with door 13, guide rollers 12 and 14, a worm reducer (i = 40) with electric

motor (1.7 kv) 10 and chain drive 8, rotating the drum, pipe 11 with stop valve 15 and drain valve 16.

The inside of the drum is lined with oil- and gas-resistant rubber, protecting parts from bumping against its walls. The end walls of the drum are fastened to rubber-tire wheels (tires from support wheels are used) which mate with the driving rollers, significantly reducing the noise and vibration during operation.

The parts are placed in the drum through a special door, the drum drive is turned on, as well as the pump and the fan. Blocking valve 15 should be closed, valve 5 open. The white spirit is pumped from the tank through line 4 then into the spray tube inside the drum. Since the walls of the drum have tiny holes, the white spirit drains back into the tank. At the end of washing, the pump is turned off and the line is closed with valve 5. Valve 15 is opened and compressed air is blown in. After the blowing cycle, valve 15 is closed and the drum drive is turned off. The parts are then removed from the drum through the door. Washing and drying time depend on the size and weight of the parts put in the machine.

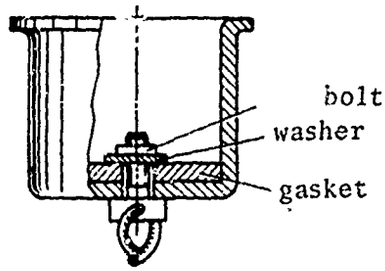
When working with the machine, fire safety rules must be closely followed.



A Portable Tool Case for the tools necessary for adjustment and installation work involving calibrated tightening of nuts and bolts has been put together by Captain of Technical Service Ye. Demin.

The sockets for the torque wrench are carried in two containers covered with a hinged plate, held in the closed position by a spring clamp.

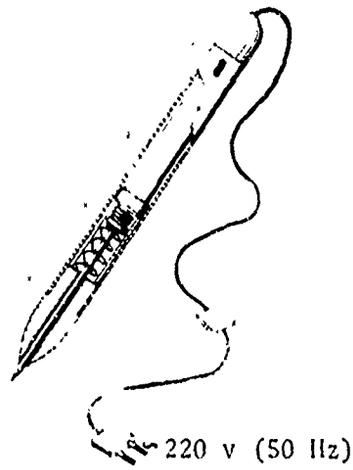
Instructions for use of the torque wrench and tools are carried on the inside of the top cover under plexiglass. The case measures 570 × 360 × × 130 mm.



Gaskets of Gasoline-Resistant Rubber (polyethylene or polyvinylchloride), Engineer Major N. Burtyshev reports, should be used in place of paronite gaskets in the caps of the RP-34 and RP-40 delivery valves of gasoline fillers, fuel pumps and other fuel transfer equipment.

After removing the paronite washer and rivet, the hole in the cap must be adjusted to fit the diameter of any available bolt. Then a gasket is cut from any available gasoline-resistant rubber (up to 5 mm thick), a hole is made in it for the bolt and the gasket is fastened into the cap.

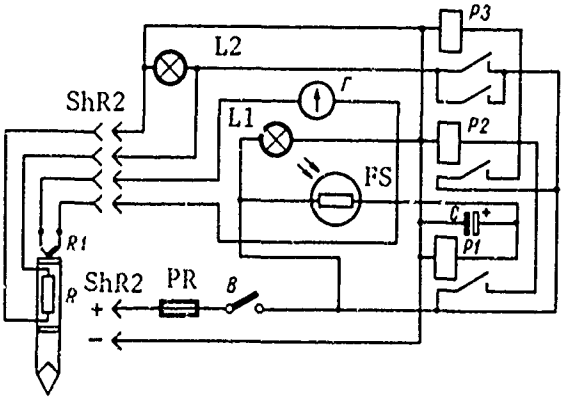
These gaskets have high stability and are not ruined by exposure to fuel.



An Electromechanical Device suggested by Soviet Army employees N. Kapichula and Yu. Lapin is convenient for making of various number, formula and letter symbols on wax paper during assembly of technical texts for printing.

The device consists of electromagnetic relay 5, powered by the 50 Hz ac line, return springs 3, glass tip 1, carrying the armature of writing needle 2. All elements are contained in body 4, consisting of a ball point pen case. Switch 6 turns the device on and off, condensor C1 selects the operating mode of the relay winding.

The armature of the relay moves in and out, acting on the needle through a spring.



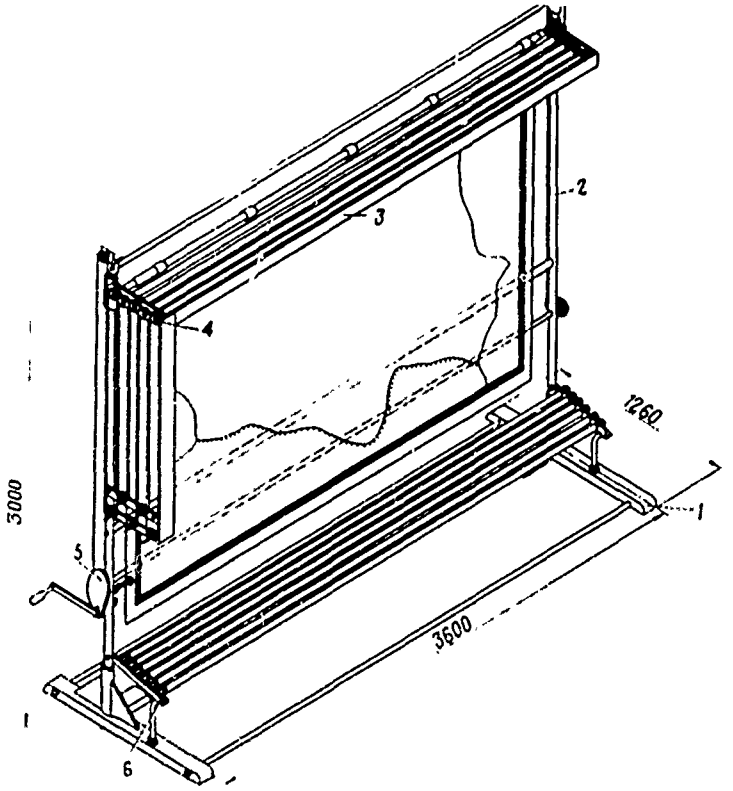
An Electrical Soldering Iron with a Temperature Control device, Engineer Lt. Col. A. Sheyman reports, has been produced by Soviet Army workers A. Dudarev and I. Fomin. Using this iron, soldering can be performed at the optimal temperature (for the solder used).

The temperature control consists of thermocouple R1, mounted in the iron, measuring device G, a relay amplifier with three relays P1, P2 and P3 (an electron tube or transistorized amplifier could also be used), photoresistor PR and its associated lamp L1. All elements of the circuit (except for the thermocouple) are mounted in a metal case.

When the soldering iron is connected to the line, lamp L1 lights up, illuminating the photoresistor. The resistance of the resistor drops sharply and sufficient current passes through it to cause polarized relay P1 to operate, the winding of which is connected in series with the photoresistor. Relay P1 connects intermediate relay P2, which in turn connects power relay P3. The contact to relay P3 connect the heating element of the iron. The rod of the iron begins to heat up, simultaneously heating the junction of the thermocouple. The thermal emf arising at the junction is recorded by the sensing device (its needle is deflected). When the temperature required for the soldering used is reached, the needle interrupts the light beam striking the photoresistor. The resistance of the photoresistor increases sharply, correspondingly decreasing their current which passes through it. The winding of relay P1 is then no longer powered, its contacts open, removing the power from the windings of P2 and P3. The soldering iron turns off. Its rod cools, the temperature of the thermocouple junction drops, the thermal emf decreases, the needle of the device moves, unnumbering the window through which the light shines. The cycle is then repeated.

The authors use the following elements in the iron: a type FS-K photoresistor, an indicator from the TVG-1 set as the sensing element, and three relays: P1 is an RPS-7, P2 is an RES-6 and P3 is a TKE-53PD.

The iron can be equipped for several types of solder, i.e., can be made universal, by increasing the number of photoresistors and illuminating lamps.



An Elevated Support for a Set of Maps (10 maps) measuring up to 3.5 × 2.5 m, Engineer Major E. Keyzmon reports, allows maps to be shown rapidly in any sequence and allows the entire set to be changed quickly. The support is simple, is easily dissembled and is stable on any footing.

It consists of base 1, two supporting guide pipes 2, connected by two fixed spacers, map carrier 3, lifting mechanism 5, map rolling mechanism 4, a spare set of rollers (5) and two brackets 6.

The base consists of two angle pieces with welded pipes, connected by two spacers. The parts of the elevating mechanism are carried in the lower portion of the left support: a shaft, a driving gear with a crank, a driven gear with a pulley, a second pulley, two supporting rollers, a stop, the cover and two steel cables.

The map case consists of two guiding pipes with frame, the left side of which has apertures for the supporting ends of the rollers, while the right side carries supporting angle pieces for the bearings. The left side of the case has slots which carry the map rolling mechanisms.

To mount a map, its upper end is fastened to the roller (by making two or three turns around the roller). The ends and glue points are then held with clamps. The map is rolled up onto the roller, its lower end is then fastened with screws (nails) and wooden bars. The roller and map are set in the case: the slot end must fit in the proper slot of the rolling mechanism, the other end fits into the support. A second set of rollers with maps is fastened to the bottom brackets. The case with rollers is then raised using the lifting mechanism to the required height, after which it is fixed in place with the stop. The maps are rolled or unrolled by rotating the crank. To change a set of maps, the lifting mechanism is unblocked and,

by rotating the crank in the opposite direction, the case is lowered. For convenience, the brackets of the spare set provide room for six rollers.

PLANNING OF INVENTORS WORK

Lt. Col. I. Stepanov p 44

A question by Colonel D. Pilyugin as to the planning of inventors and rationalizers work is answered by contributing editor Colonel I. Stepanov.

Inventors and rationalizers work is planned by the Commission on Inventions of the Chast'. The plan is made up for a year or a training period, is coordinated with the political Deputy Commander of the Chast', approved by the Commander and reported to the personnel. Its main features should be included in the calendar plans for combat and political training.

The plan for inventors and rationalizers work should first of all, for the participation of inventors and rationalizers in socialist competition and for checking of the fulfillment of the obligations which the men take on.

For propaganda purposes, plan exhibitions of the technical creativity of the innovators, planned to have then appear on radio, publish bulletins, photographic and color newspapers. It is a good idea to plan for the use of rationalizers rooms, for meetings of technical clubs and for measures to increase the knowledge of the rationalizers (lectures, discussions and consultations).

The composition and presentation of thematic assignments for the inventors and rationalizers, organization of the work of creative teams and public design bureaus, presentation of individual assignments and monthly collection and introduction of suggestions should be planned for.

Be sure to check the condition of inventors and rationalizers work in the Podrazdeleniye, helping its organizers, company and battery committees for rationalization (where present).

The composition of financial reports, reports of the successes of rationalizers work (in correspondence with the applicable table for reports), preparation of speeches on problems of invention at Party and Komsomol Meetings, as well as service assemblies -- all of these steps should find their place in the plan.

Meetings of the Commission on Inventions should be held at least twice per month. This will allow the established time for analysis of suggestions of 15 days to be observed. Meetings should be held even if no suggestions have been turned in for analysis. The Commission can discuss current problems: it can hear the reports of organizers of inventors and rationalizers work in the Podrazdeleniye, can check the fulfillment of the plan and if necessary can make the required changes to the plan.

The form of the plan is simple: only the planned measures (time of performance and responsible person) are indicated. The responsible person need not necessarily be members of the Commission, other officers also being used for the organization of inventors and rationalizers work.

The Chairman or Secretary of the Commission checks the performance of the plan. A signed and approved copy of the plan is kept with general correspondence on inventions and rationalization. The Commission also has a second file, containing materials on suggestions, correspondence concerning them, minutes of meetings of the Commission (if there is no special minutes book). Both of these files, as well as the book in which suggestions are recorded, should be kept up according to the requirements for file keeping.

Practice has confirmed that wherever inventors and rationalizers work is planned and steps are taken precisely at the established times, technical creativity will be at a high level. For example, in the Chast' where the Secretary of the Commission for Inventions is Major V. Yil'inykh, a precise plan of operations was made up for the past year and followed exactly. The introduction of suggestions accepted was checked regularly, the personnel were involved in technical creativity, socialist competition was developed among the innovators and great attention was turned to collective creativity.

And here is the result. During the year, the rationalizers of the Chast' turned in 100 rationalizers suggestions, 98 of which were introduced. Here every fourth man is a rationalizer. Over 30% of the suggestions were developed by creative teams.

HOW TO CALCULATE SAVINGS

Engineer Lt. Col. V. Bolotov p 44

How can the savings achieved by introducing rationalizers suggestion designed to restore worn parts be calculated? This question was asked by Lt. Col. V. Simakov.

Contributing editor Engineer Lt. Col. V. Bolotov answers this question.

According to the explanations of the Committee for Inventions and Discoveries of the Council of Ministers USSR, calculation of the savings achieved by this type of suggestion is performed in those cases when the repaired parts are equal in quality to new parts and if the parts were previously repaired using special funds assigned for this purpose. If the Chast' or enterprise is supplied with parts from a central source without paying for them, and the norms of supply are not decreased after introduction of the suggestion, no savings are calculated, since the award must be based on the actual value of a suggestion.

It may be that the restored parts have a shorter service life than new parts. Then the savings must be calculated considering this reduced service life.

If the worn parts were written off as scrap, the cost of the scrap must be considered in calculating the savings; if the parts were assigned some reduced value for any other reason, this value must be considered.

It should be kept in mind that suggestions for the use of worn parts containing no technical creativity cannot be rewarded.

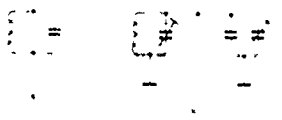
In calculating the savings produced by introduction of these rationalizers suggestions, use the following formula:

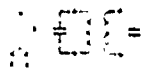
$$\text{Economy} = \frac{a - c}{b} - \frac{A - C}{B} H, \text{ where}$$

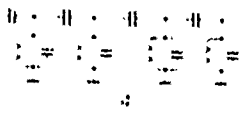
a is the wholesale price of the part, b is the service life of the new part in years, c is the cost of the scrap in the part used, A is the full cost of the restored part considering overhead, B is the service life of the restored part in years, C is the cost of scrap after use of the restored part, H is the number of parts restored.

IN THE LABYRINTH OF CIRCUITS

Unsigned p 48







Typical circuits used for oscillators (see Figures) can be recognized at a glance.

Oscillating circuit 1 consists of a coil and condensor connected in parallel. The coil (in its magnetic field) and condensor (in its electrical field) can store energy. In the oscillating circuit, small externally applied current pulses develop great fluctuations in current due to the transfer of energy from the coil to the condensor and back. This phenomenon is most clearly seen when the frequency of the external current pulses coincides to the natural (resonant) frequency of the circuit.

The ability to resonant, to respond to a given frequency, allows oscillating circuits to be used to separate oscillations at different frequencies. For example, if we see a coil in the high frequency portion of a circuit, we

should look to see whether it is connected to a condensor and whether this forms an oscillating circuit. The symbols of parts representing the circuits are always placed side by side.

However, several condensors may also be connected into an oscillating circuit. For example, a small tuning condensor is frequently connected in parallel to the coil or condensor 2, allowing inaccuracy of the electrical parameters of the basic parts to be adjusted. If the circuit need not be studied in detail, all of these symbols should be read as one.

Many electronic devices include a combination of two circuits 3, called a band pass filter (oscillations can pass through this circuit only in a definite frequency band). This system should also be recognized at a glance, and we should only to look to see how the input and output ends of the circuit are connected. Multicircuit band pass filters such as 4 are also frequently used.

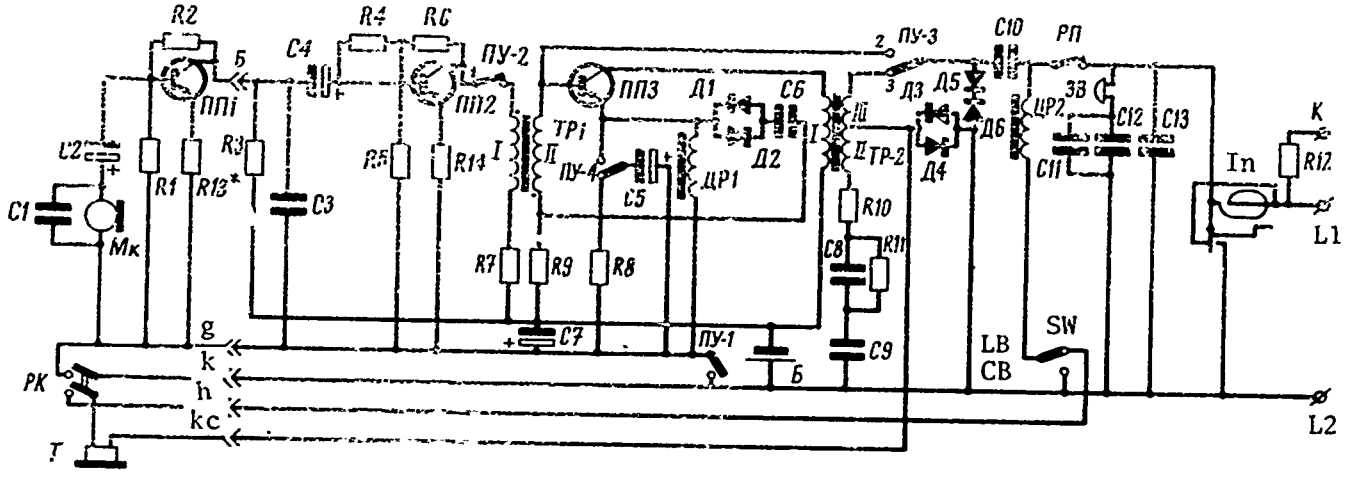
FIELD TELEPHONE APPARATUS

Unsigned

One of the most common means of wire communications is the type TA-57 universal field telephone apparatus. It can be used to transmit and receive commands and reports, for remote control of SW and USW radio stations. The TA-57, without intermediate stations, can provide reliable communications over type P-274M field cable over distances of up to 44 km, and over permanent overhead lines of 3 mm diameter wire for up to 150-250 km. The circuit of the apparatus allows the range of communications to be increased by 35-40% by using a special receiving amplifier. The dimensions of the apparatus are 222 × 165 × 79 mm; the weight with battery is about 2.8 kg; time required to set up the telephone and connect it to the communications line is 1-2 minutes. It operates under power from local or central batteries (in LB and CB systems). In an LB system, the power supply at MB is provided by a type GB-10-U-1.3 battery installed in the apparatus, with a service life of 5 to 6 months.

The apparatus consists of a hand set, upper panel, removable section and plastic box with hinged cover. The apparatus features a printed circuit using semiconductor devices and miniaturized parts.

In the transmission mode, a portion of the electrical system is used including the electromagnetic noise-resistant microphone Mk type DEMSh-1A and a three-stage transistorized amplifier using type MP13-MP15 transistors (see figure). All three stages of the amplifier are made with grounded emitter. The first stage is loaded by resistor R3 and coupled to the second stage through condensor C4. The second stage is connected to the third stage by transformer TR1, the third stage is connected to the line through output transformer TR2. The amplifier is powered when the talk button PK is depressed.



Schematic Diagram.

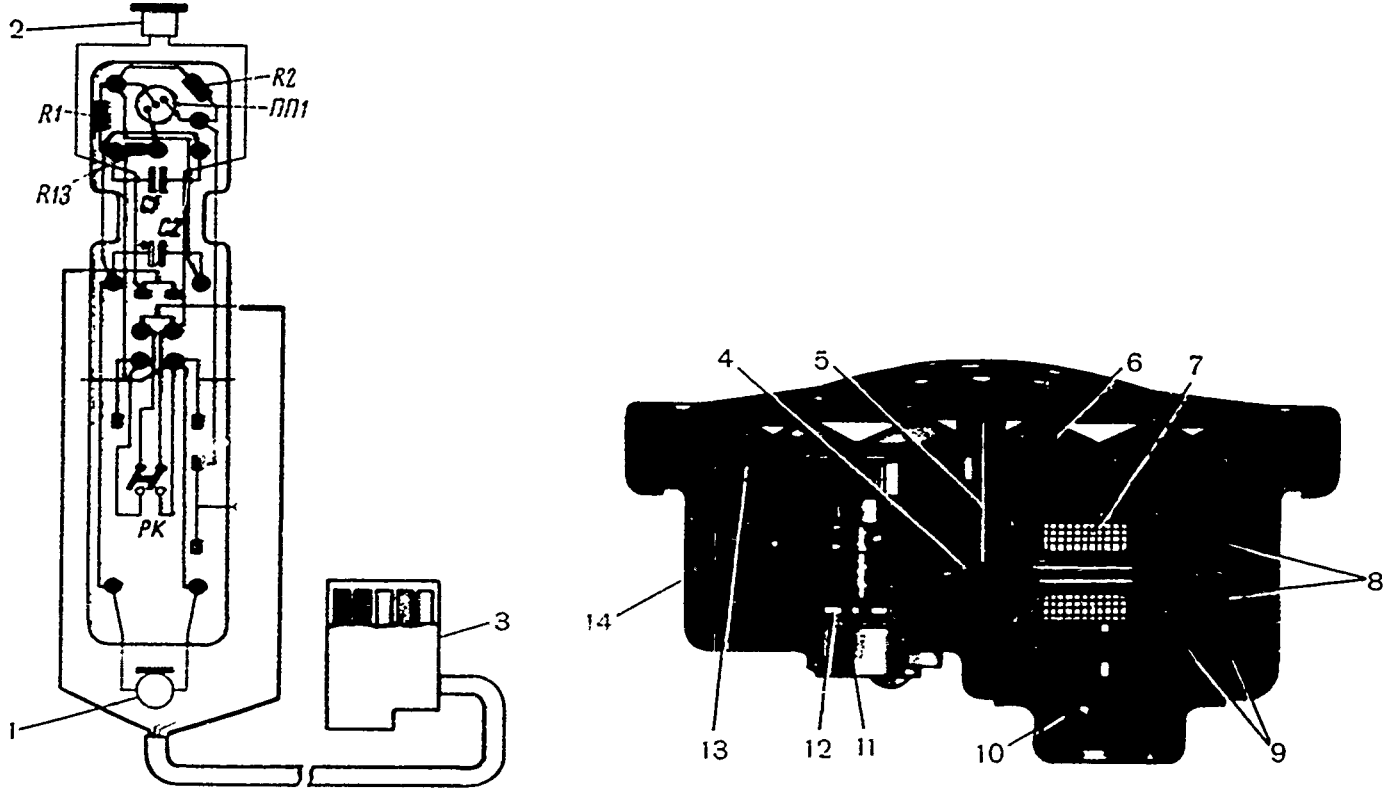


Diagram of Hand Set:

Key: 1, microphone; 2, speaker; 3, cable and connector; 4, armature; 5, arm; 6, membrane; 7, coil; 8, permanent magnets; 9, pole tips; 10, ceramic plug; 11, metal plug; 12, adjustment nut; 13, base; 14, body.

Condensor C13, connected in parallel to terminals L1 and L2, prevents self-excitation of the apparatus when it is connected to a shorted line or commutator. This condensor decreases the high frequency output of the device, and also serves as a load for the connecting lines, decreasing the imbalance of the circuit.

In the receive mode, the communications line is connected to a type DEMK-6A speaker, which converts the electrical energy to sound (acoustical) energy. Its membrane, in contrast to the membrane of ordinary electromagnetic speakers such as the TK-47, is not a portion of the magnetic circuit and is not directly acted on by the magnetic flux. An armature rigidly connected to the membrane by an arm is held in the magnetic field. The armature passes through a coil and is clamped between two permanent magnets. The middle portion of the armature is in the air gap between two pole tips. It is set in the neutral position by means of an adjusting nut and the permanent magnetic flux does not saturate it and, consequently, does not prevent the transmission of the alternating flux, as is the case in speakers in which the membrane is located in the magnetic field.

The electromagnetic system of the speaker is mounted on a cast base made of a nonmagnetic material and enclosed in a sealed body. The internal volume of the speaker is connected to the atmosphere through a special ceramic plug. This prevents possible deformation of the membrane, which is made of thin, corrugated aluminum. The adjusting nut can be reached through a metal plug in the rear wall of the body.

The speaker can convert not only electrical oscillations to acoustical oscillations, but also acoustical oscillations to electrical oscillations, i.e., it is also a microphone. Therefore, to prevent conversations held near the apparatus from being transmitted into the line, the hand set must be returned to the seat on the top of the apparatus after conversations are completed. This opens contacts RP and the speaker and output transformer are disconnected from terminal L1.

On short lines a limitor consisting of a nonlinear resistor made of two type D2V diodes D3 and D4 connected in parallel in opposite directions is connected parallel to the telephone to reduce the loudness. The shunting action of these diodes increases with increasing current from the line.

Separating condensor C10 protects the speaker from the inductive call received by bell ZV. The impedence of the bell, connected parallel to the line, is great for audio frequency currents, so that it practically does not shunt the telephone.

When the device is used for remote control of radio sets, the operating mode switch (SW) is put in position LB. When the talk button PK is depressed, choke C2 is connected to terminal L2 and forms the radio set control circuit, which is put in the transmit mode. When PK is released, choke C2 is disconnected from the line. The dc circuit is opened and the radio set is switched to receive.

In order to protect the apparatus from early failure, the hand set and apparatus should not be subjected to sharp jolts and shocks, should be protected from water, dust and dirt. If water gets into the apparatus, it should be immediately removed from the box, handset and connecting plug. Water should not be shaken from the microphone by striking it with the hand. When possible, the apparatus should be dried in the sun, wind or in a dry room.

To remove dust and dirt, periodically remove the upper panel and remove the plate from the box. Be careful to perform the operations in the following sequence: first remove the battery, dividing wall, hand set, then turn over the apparatus and remove the eight screws marked with the circles. The printed circuit can be wiped only with a brush or a soft cloth wet in alcohol, never in gasoline.